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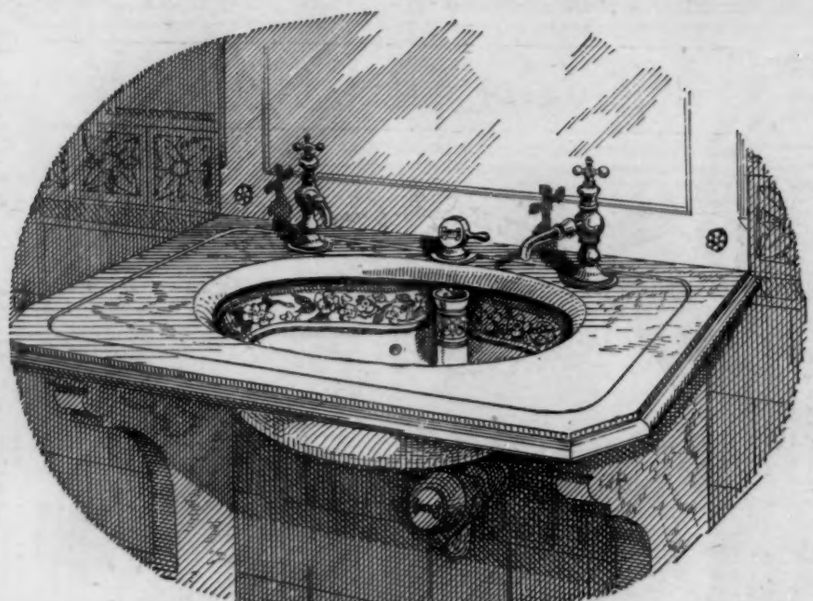
(Gelatine Print issued only with Imperial Edition.)
Stable at Lorhada, New York, N. Y.
Church of All Saints, Pontiac, R. I.
Pulpit and Choir in the Kneeland Memorial Chapel, Lenox, Mass.
Residence of Senor Enrique Concha y Toro, Santiago, Chili, S. A.
Competitive Design for Church, Davenport, Io.
House at Charlton Heights, D. C.
House at Bridgeport, Conn.

THE SANITAS LAVATORIES.

(BASIN, BATH-TUB, PANTRY-SINK.)



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A LARGE portion of the profession seem to regard the protest against the Massachusetts State-House competition as a matter of local interest only, and overlook the fact that the wording of the text makes the protest one "against *this form* of competition," and it is solely because of this that we invite signatures from architects in all parts of the country. We hope that next week's list will show a very material increase over the one published to-day.

A CURIOUS controversy is going on in the newspapers between the Westinghouse Electric Company, representing a large amount of vested interest, on the one hand, and Mr. Harold P. Brown, who claims that he represents the public interest, on the other. It will be remembered that Mr. Brown, some time ago, wrote a letter to the New York *Evening Post*, over his own signature, calling attention to the dangerous character of the alternating electric currents used in the Thomson-Houston system, the Jablochkoff system, and several others. In reply to this letter, various anonymous insinuations were circulated, to the effect that Mr. Brown was in the pay of the Edison Electric Company, which uses only continuous currents, and implying that he was attempting to deceive the public, for the benefit of that company, by attributing imaginary dangers to rival systems of electric-lighting. Mr. Brown then, to fortify his opinion by the strongest evidence, applied to Mr. Edison for the use of his great electrical laboratory at Menlo Park, for the purpose of trying whether alternating-currents of the strength used in lighting would be fatal to animals. Dogs of different sizes were first operated upon, and, while one weighing fifty pounds received six successive shocks, the last shock lasting two and one half seconds, with a continuous current of intensity varying from one thousand to fourteen hundred and twenty volts, without experiencing any injury, a fifty-six pound dog was killed in five seconds by an alternating-current of one hundred and sixty volts, a little more than one-ninth the intensity of the harmless continuous current. As soon as these results were published a new attack was made upon them and Mr. Brown. The Society for the Prevention of Cruelty to Animals was called upon to put a stop to the experiments, while the experiments themselves were declared to be of no value as showing the relative effect of alternating and continuous currents on human beings, because the dogs treated were smaller than men. Mr. Brown then, with the coöperation of the Commission appointed by the State Government of New York to determine the best method of executing criminals by electricity, carried out a new series of experiments upon a horse weighing twelve hundred and thirty pounds, and two calves weighing about as much as an average man. With all death followed in a few seconds the application of an alternating-current of seven or eight hundred volts intensity.

APPARENTLY, the public apprehension must have been so aroused by these experiments as to make itself felt in the business of lighting by alternating-currents, and the Westinghouse Electric Company, which is said to control in this country all the systems employing alternating-currents, thought fit to hire a large number of newspapers to publish a letter, to which every honorable man must be sorry to see the name of Mr. George Westinghouse, Jr., subscribed. The letter begins with a reiteration of the insinuation, which has been refuted over and over again, that Mr. Brown is "conducting his experiments in the interest and pay of the Edison Electric Light Company," followed by an assertion that "it is generally understood" that as the Edison Company's business may be vitally injured if the alternating-current apparatus continues to be successfully introduced and operated, "the Edison representatives, from a business point-of-view, consider themselves justified in resorting to any expedient to prevent the extension of the system." As the idea that "the Edison representatives" have anything to do with the "expedients" in question rests entirely on the false assumption that Mr. Brown is one of those "representatives," it does not need to be disproved; but most people who have followed the course of electric-lighting in this country will be tempted to point out to Mr. Westinghouse that with the Edison Company the "business point-of-view" has hitherto been generally identical with the point-of-view of honesty and decency, and that, if he considers the systems that his company controls superior to the Edison system, he will get more public sympathy by describing their advantages without any accompaniment of bragging and slanderous imputations. Proceeding to discuss the facts in the case, Mr. Westinghouse says that the animals killed by the alternating-currents in Mr. Brown's experiments were "carefully placed" so as to receive the shock in a way that would be impossible under ordinary circumstances, and offers to produce "a large number of persons" "who have received a shock of one thousand volts from alternating-currents without injury," explaining further that alternating-currents are less dangerous to life than continuous currents, because the latter decompose the tissues, while the former only affect the nerves.

MR. WESTINGHOUSE'S contemptuous and abusive advertisement has now, very naturally, stirred up Mr. Brown to make a reply which is a little more vigorous than we could wish, inasmuch as it goes out of its way to impute to Mr. Westinghouse motives which would be much better left for the readers of the correspondence to infer for themselves. In regard to the facts of the matter, Mr. Brown says that however it may have been with Mr. Westinghouse's friends, who have "withstood" pressures "exceeding one thousand volts" "without permanent inconvenience," many people have been already killed by the alternating-currents, and many more have been crippled for life, and are supported by pensions from the electric-lighting companies which furnish such currents. Moreover, he asserts that the alternating-current wires cannot be made safe, for the reciprocating movement greatly increases the tendency of the electricity to leave the wire, and, according to his tests, the leakage from the wires used by the alternating-companies to the ground is sufficient to kill or cripple any person standing on a damp place and touching either wire, while with a continuous current, even of very high intensity, a fatal shock can only be received by touching both wires of the circuit. As to whether it is more agreeable to have one's tissues decomposed by a continuous current, or one's nerves shocked by an alternating one, he proposes a simple experiment. As he thinks the alternating-current the more dangerous, and Mr. Westinghouse says that it is less so, he suggests that Mr. Westinghouse and himself should meet in some public place and each grasp a pair of wires of his favorite variety. Through these wires should then be sent electrical currents, beginning with a pressure of one hundred volts, and increasing by fifty volts at a time. Mr. Brown, who is to hold the continuous-current wire, offers to lead at each increase of

pressure, and proposes that the one who first cries enough shall be considered to have acknowledged himself in error. This is certainly a fair offer, and, if Mr. Westinghouse does not like to leave his business for such trifles, we strongly advise him to send one of his thousand-volt salamanders as his champion. As the controversy now stands, his friends maintain that the current used in his system is "absolutely harmless," and, consequently, we suppose, that the persons who have been killed on touching the wires carrying it must, by a singular coincidence, have died of consumption, or old age, or some other natural ailment just at that instant. Mr. Brown maintains that an alternating-current of one-sixth the intensity used by the Westinghouse people has killed a large dog in five seconds in his experiments, and that, for safety, the tension of alternating-currents ought to be limited by law to three hundred volts; and unless the Westinghouse companies can show a man receiving a shock of greater force than this without injury, we are much inclined to think that the public will agree with him.

A CURIOUS story about an American town comes to us by the way of Paris. According to this, there is in the city of Brooklyn a lot of land which has no owner. The lot is not very spacious, being only twenty inches wide, by, apparently, two hundred feet or so in length, but it is regularly taxed to "Owner Unknown," and as regularly put up at auction for the non-payment of taxes by this mysterious individual, but finds no purchaser, the building laws of New York being unfavorable to the erection of a house on a lot of those dimensions. The explanation given for the origin of this orphan estate is that the block was laid out many years ago with the standards of length then in use, but was not divided into lots. Long afterwards, when the land had become valuable, the sale of the tract in lots began, the measurements of the lots being taken from the street-lines, which had been fixed at the original survey. The length of the legal standard for New York had, however, changed since the survey was made, and, when all the lots had been sold by measurements conforming to the new standard, there still remained the strip in question, which was included in nobody's deed, and could not be conveyed to any one without an apparent violation of the laws of arithmetic.

ALTHOUGH this explanation may satisfy the Parisians, we are too proud of the astuteness and ingenuity of our countrymen to let it pass without question. We have seen a lot not much more than twenty inches wide in an American city utilized for a very profitable little fruit store, by the simple process of roofing it in, and furnishing it with a movable front, which served as door, counter and window, while there was plenty of room for reserves of goods in the space behind; and it is incredible that the Brooklyn people should be so blind to commercial opportunities as to let this one escape. Nor can we quite believe in the story of the origin of the surplus lot. So far as we know, there has been no change in the American standard of length, since Brooklyn was laid out, which would account for any such residuums of territory; and it is far more likely that the original surveyor used an incorrect chain, or forgot just where the end of it had been, and drove his stakes somewhat at random. Scores of errors of this sort are discovered in most of our States in retracing with modern instruments the boundaries given in old deeds, but any excess of territory is usually amicably divided among those who have claims upon it.

MR. HERBERT D. APPLETON, the earnest and thoughtful President of the London Architectural Association, recently read a paper before the Birmingham Architectural Association on the "Affiliation of Student Architectural Societies," which is full of valuable suggestions, as well for us as for those to whom it was particularly addressed. By the new charter of the Royal Institute of British Architects the London Architectural Association has a representative in the Council of the Institute, and Mr. Appleton thinks, with reason, that this arrangement could be made much more useful to the younger members of the profession throughout Great Britain by the establishment of somewhat intimate relations between the London Association and those which already exist, or which may be formed, in the provincial towns. It is a curious fact that the adoption of the compulsory examination for admission to the Institute has greatly fostered the development of student societies, which find plenty of reasons for existence in the advantages which their classes offer for preparing their members for the Institute examination, and the ready communication between the Institute and the students, afforded by the presence in the government of the Institute of a representative of the federation of student societies, would be most useful in preventing misunderstandings, in improving from year to year the system of examinations, with the concurrence of all the parties interested, and in promoting professional attainment and inculcating the best professional ethics. Beyond this, however, Mr. Appleton thinks that a regular communication between the student societies will be of much value in many ways. It would not take long, for instance, for a body comprising several hundred young men to form a lending-library of all the best architectural books, journals and photographs, and pass them from hand to hand, under the advice of persons familiar with the subject, until all the students who cared for it had acquired some knowledge of the standard works, as well as special acquaintance with such particular departments of art or science as pleased them. It seems to be the case in England, as here, that the public libraries are deplorably poor in books of value to the student of architecture. In this country, according to our experience, the few libraries which contain even a meagre assortment of standard works will not allow them to be taken from the room in which they are kept, so that they are almost entirely unavailable for young men employed in offices, while the selection is usually so poor that students who have not been warned what to avoid are likely to waste a large part of the time which they can manage to devote to them. Under such circumstances, a proper students' lending-library would be invaluable, while, as Mr. Appleton suggests, until this could be formed, much good might be done by appointing members in the various towns to examine the local libraries, and urge the purchase of books from a list to be prepared for the purpose by a library committee or some similar authority.

BESIDES all this, Mr. Appleton proposes that the local societies should mutually help each other in facilitating the study of buildings, both ancient and modern. He cites the example of the Cycling Club, which, by the appointment of "consuls" in all the principal English towns, to direct tourist members of the club to places of interest, and give information about roads and inns, has immensely facilitated the use of wheels for pleasure travelling, and proposes that the affiliated societies of students of architecture should in the same way appoint members in as many places as possible, as local advisers to students on sketching-tours. This, to our mind, is one of the most valuable suggestions ever made for the benefit of young architects, and the plan might well be carried out on an international scale. Every architect who has made a sketching-tour in an unfamiliar district knows the difficulty of finding what he wishes most to see. The guide-books give him a little information about the principal buildings, and tell him how to find the cathedrals, which are usually visible for five miles around, but they are silent in regard to thousands of lovely "bits" more available for sketching, and quite as instructive as the more renowned structures. In fact, the great cathedrals are so familiar by photographs and drawings that they tempt the sketcher less than buildings which he never heard of before, and to which his sense of proprietorship as a discoverer gives an interest and charm which fix their beauties of design or construction in his mind, and lend facility to his brush and pencil. We can well recollect the pleasure with which we stumbled upon the little Carmelite church and convent in Paris, on the south side of the Seine, near the Hôtel Cluny, or the church of Saint-Père at Chartres, or an old tower of brick and terra-cotta in a back-yard at Milan, and how novel and delightful they seemed after the familiar grandeur of the cathedrals, and do not doubt that many of our readers have had the same experience, and have, like us, lamented the fortune which, while it brought us to a few treasures, led us in ignorance past hundreds of others, to which a fellow-student acquainted with the region could have directed us. In the study of modern architecture, which Mr. Appleton strongly recommends to young men, the system of architectural consuls would be of the greatest benefit. We often have occasion to furnish professional tourists, both young and old, with lists of the most interesting buildings in the American towns with which we happen to be acquainted, and, judging from our own experience, the amount of time that could be saved by having such lists prepared by a competent resident in each place would be enormous.

ARCHÆOLOGICAL CAMPING IN ARIZONA.[1]—II.

Elephant de la Bastille.- Suggestion of M. Alavoine.

WITH sundown the air has suddenly become sharp and keen, much like that of late October at home, differentiating the midwinter night of this region considerably from the midwinter day. The stars glitter brilliantly in the clear, cloudless sky, and an impressive silence broods over the country, hardly disturbed by the slight sounds of the camp—the Mexicans quietly chatting in their tent, the cook setting things to rights in the kitchen for the night, and the "chomp, chomp, chomp" of the animals at their fodder in the neighboring corral. The lights in the tents shine through the canvass and give them a cheery aspect: from the inside there is heard the steady hum peculiar to blazing wood in confinement, for a genial warmth is maintained in little stoves simply made of sheet-iron fashioned into a cone shape and kept full of mesquite wood, which is almost as hard and heavy as iron and gives out a heat like coal. These stoves, with the pipe running straight up from the top of the cone are simply inverted funnels, with a little draught-hole at the bottom. The cold of the nights would occasion no discomfort to house-dwellers in this climate, but it easily penetrates the tents, and brisk fires are needed for comfort, even late into the spring.

Mr. Cushing's tent, occupying the centre of the camp, has a cosy, home-like appearance, with the touches of decoration and aspect of order that betray the feminine presence. It is a large wall-tent, divided by a curtain into two rooms. A canvass covers the ground and makes a neat floor, cases of shelves contain a considerable reference-library for use in working-up the results of the excavations from day to day, and there is a convenient portable desk; shelves, desk, etc., all made so as to be packed into small compass and easily transported when camp is moved. Bright colored Zuñi blankets cover the two cot-beds, and there are tastefully displayed on the walls and shelves some handsome examples of the decorated basketry of the Pima Indians, mostly with bold, rich designs woven in black and white, and sometimes additional decoration painted in red and green. There are also a few specimens of the ancient pottery excavated near by. A sewing-machine lends an air of domesticity to the place, and several candles illuminate it.

Mrs. Cushing, who is the custodian of the smaller treasures of the collection and guards them with jealous care, brings them out and delights my eyes with some exquisite arrowheads, carefully chipped and graceful in form, made of quartz and agate, or other colored stone, evidently chosen with regard to its beauty; ornaments of turquoise and beads of shell; bracelets and finger-rings carved from sea-shells, and last and most beautiful, a wonderful frog found wrapped in asbestos in a sacred jar excavated from the ruins of the great temple of Los Muertos. It is an exquisite piece of work, showing not only a genuine æsthetic sense possessed by the ancient people, but an artistic conception and decorative quality that would do honor to our own race and civilization if produced to-day. In making it a shell similar to that of a quahaug, or "little-neck clam" was taken and on its convex side the effigy of a frog was produced in lines of mosaic-like fragments of turquoise embedded in a black cement made from the gum of the greasewood, or hediondilla. The line down the centre of the back was made in red bits of shell, resembling coral in color. The whole was worn down smooth by rubbing. The effect is extremely realistic—an exception to the conventionalism that characterizes most of the art of this, in common with other North American primitive cultures. Prof. Edward S. Morse, who visited Camp Hemenway in April, took this frog East with him for safe-keeping, and stopping over in New York he showed it to the people at Tiffany's, who expressed great delight and marvelled that such a thing could have been produced by an ancient people in this country.

The rest of Camp Hemenway consisted of a tent occupied by Mr. Hodge with his desk and records, a tent adjacent occupied by Mr. C. A. Garlick, the surveyor and practical superintendent, a small tent in which Miss Magill was domiciled, commonly known as the "dog-tent" from its diminutive size and fancied resemblance to a kennel, a tent occupied by Dr. tçn Kate, a Sibley tent for guests, a large tent for housing the collections, with a shelter of canvass, called by its Spanish name of *ramada*, originally meaning "brush-shelter," adjacent as an annex; a tent for the Mexican laborers, a tent for the photograph material and other stores, a shelter for the baggage, a little "dark tent" for photographing operations, and a shelter for the harnesses. The mules, with the two horses, are tethered around a large crib under one of the few mesquite trees that have been left standing about the camp: they need no shelter in this climate and beyond an occasional kick or bite at an encroaching neighbor they live together in amity.

The next morning I make the acquaintance of Ramon Castro, the noble-faced young Mexican who acts as foreman of the laborers; faithful, industrious, and an innate gentlemen. Later in the day Don Carlos, as Mr. Garlick is called, drives in from Phœnix, fourteen miles away, where he has been over night on his semi-weekly errand of purchasing supplies for the camp.

It is a typical morning of this region, clear, sparkling air, and the sun soon warms up the world—or all that portion that lies about us—into summerish cheeriness, melting the ice that has skimmed over the buckets in the camp and fringed the ditches with frosty lace. But off in the upland regions of Arizona, three or four thousand feet above our level, they are having some real winter, as the snow tells us that is glittering on the mountains.

A great mound lies about a quarter of a mile distant, rising in a low, broad mass of brown earth above the plain, and something like twenty-five feet above the general level. It is the ruin of the great central temple of the place, and Mr. Cushing takes me out to see it. It has been excavated sufficiently to show its construction. It was originally probably six or seven stories high, and divided into various rooms on each floor. Only the remains of two stories are now to be traced. The outer wall is very thick, something like three or four feet. The material is indurated earth, and in the course of excavation Mr. Cushing made a highly important discovery concerning the constructive methods of these people. Along the top of these outer walls is seen a double row of holes running down perpendicularly, and each row a few inches within the outer and inner face of the wall, respectively. These holes were found filled with the powder of decayed wood, and some large fragments of the wood itself were discovered. Further investigation showed that these walls were constructed by first driving a double row of stakes into the ground, and then wattling-in between the stakes so as to form two parallel lines of wattled work. Building this wattling up to a height of a foot or two, the space was filled with moistened earth, packed down firmly, perhaps by treading with the feet, or tamping with heavy stones. The wattling was then built up higher, and the process continued until the wall was carried to its full height. Thus a solid structure was formed with walls enclosed within a wattled surface. This surface formed a sort of lathing, and it was covered with a thick plastering of mud with a smoothly finished surface such as is still to be found on the walls at Casa Grande after a lapse of centuries. It was unknown that this was the method of building these massive walls until Mr. Cushing made this discovery. As soon as he saw these double rows of holes he declared what their origin must be, and said that wattling must have been used in the way it proved to have been, as revealed by subsequent investigation, where the impress of the wattling was found plainly made inside the walls. Here, then, was a most significant fact. The origin of pottery in forms of basketry has long been made familiar. This discovery showed that not only did the primitive utensils of burnt clay, but also the primitive structures with walls of clay, find their origin in basketry types. For, just as the coating of baskets with clay suggested the making of pottery, so this form of structure bears the records of the story how the primitive wattled hut, first rendered more substantial and weather-proof by a coating of mud, suggested a more massive form of construction with a basketry basis. Possibly all mud or earthen walled construction may thus have been developed from basketry.

In this connection, a subsequent discovery deserves mention. Readers of the *American Architect* may remember an article that appeared in these columns a few years ago, briefly recounting how Mr. Cushing discovered that in the ancient Pueblos the doors to the houses were made of stone slabs, through an analysis of the etymology of the modern Zuñi word for door, which signifies "a wooden stone close," showing that before boards were made available for the construction of their doors, they must have closed their doorways with slabs of stone. Thus throughout their language the successive stages through which their methods of house-construction, their implements, etc., passed in their development from lower or ancient to higher or recent types are preserved in the structure of their words. In investigating the ruins of Casa Grande, one of these "stone closes" made of mud was found in the shape of a great and heavy block of adobe, nicely finished with square corners, and accurately fitting into the place where it filled a doorway from one of the rooms to another. Subsequently, in excavating the ruins of a smaller temple in Las Acequias, one of the ancient cities near Los Muertos, a similar door of adobe was discovered lying upon the ground close to the doorway to which it belonged, its position such that it might readily be raised to fill the opening. These huge blocks were probably made in moulds of basketry, and their surfaces afterwards smoothly finished by hand. Even if moulds of wood were possible, they would have been so difficult to make with their crude implements that the idea would hardly have occurred when basketwork was so universal, and so easily made available for plastic purposes. The greater portion of the soil in these regions contains elements of clay and of natural cement, so that when indurated it hardens to an almost rock-like consistency.

From the top of the temple-mound there is a good view over the country. We are just about on the low divide between the Salado and Gila Valleys, and from this point the water in the irrigating-canals, brought up gradually to this level from the Salado above, runs down towards the Gila, instead of back towards the Salado. When the operations of the expedition began at this point something like seven months ago, it was supposed by the settlers that the supply of the irrigating-canals would hardly reach much farther southward, but the researches showed that the irrigation-works of the ancient inhabitants penetrated far beyond, and, in consequence,

[1] Continued from page 10, No. 680.

the available land in this region has all been taken up, and there has been a great development all around, with thousands of acres brought under tillage.

Therefore, the landscape has undergone a rapid transformation. When the camp was established here, the section upon which the main portion of Los Muertos stands was covered with a thick growth of very old mesquite trees. Only the great mound betrayed the existence of an ancient city on the spot. The other ruins were hardly discernible. The whole place has now been cleared and "brought under water," as they say here; that is, brought under irrigation. Only a few trees are left standing just about the camp, and the owner of the section, who took it up under the Desert-land Act, has sown the greater part of it with barley. Thus the land is resuming the fertility which characterized it ages ago. The settlers have made a mistake in making such a clean sweep of the mesquite. With a few dozen trees left on each section, standing singly or in groups here and there, the appearance of the landscape would have been much improved, and shade afforded for cattle in their alfalfa pastures during the summer heat. With its thirst amply gratified, as it is on irrigated land, the mesquite becomes quite a different tree from the scraggly, dwarfed growth of the desert-plains, with misshapen, unsound, contorted limbs. Given plenty of water, it becomes inspired with new vigor, and it lifts its head proudly high into the air, animated with health that becomes manifest in symmetrical shape.

Objects of considerable size soon lose themselves in the vastness of such a landscape as that spread before us; the white tents of the camp become mere specks on the plain, and the little shanties of the settlers on neighboring lands become so diminutive as to afford a scale for estimating a distance that otherwise would prove very deceptive in this clear air.

The land chosen by Mr. Cushing for his excavations has been kindly left undisturbed by the owner, beyond clearing it of its trees. Low mounds slightly rising from the level indicate the ruins, and large areas laid bare testify to the industry of the laborers whom we see, here and there, casting out the earth with their shovels. We stand a long time watching them at their work. The Mexican laborers have gained something of the enthusiasm of Mr. Cushing, and are eager for results. When something is found they gain new encouragement, and their shovels and picks are plied with greater celerity. They are gentler, more impressionable and receptive than men of a corresponding grade in our own race, and seem to have a greater natural intelligence. Their training has made them careful, and, when evidences of the presence of pottery, of skeletons, or other objects are encountered, they proceed cautiously, and do their best to remove intact what is found. Ramon, in particular, has been an admirable disciple under Mr. Cushing's schooling, and he has become a practical archæologist, with an almost intuitive capacity for discerning the presence of ruins and relics. He can trace the course of walls unerringly by indications imperceptible to any one else except Mr. Cushing, and marks out with his shovel the lines for the men to follow in their excavations. He will likewise tell just where the skeletons are to be found in the house-ruins, and one day, at Las Acequias, I see him fill Doctors ten Kate and Wortman with astonishment and admiration; they are anxious to find some good skeletons, and are beginning to be discouraged at the prospect of encountering them in a certain excavation, where two badly-decayed ones have been found near the surface. "Let us dig deeper," said Ramon, "and we shall find three fine *difuntos:* one here, one here, and one here," indicating the places and the positions of their heads, and, sure enough, they were soon found. "*Es usted un hombre de mucho talento!*" I remarked, in response to Dr. Wortman's enthusiastic request to "Just tell him he is a mighty smart man!" and a modest smile of gratification illuminated Ramon's expressive features.

The excavations of the house-ruins were usually carried to a depth of three or four feet below the present surface of the country, laying bare the remains of the walls, and showing the interiors. The only evidences of these houses, which had long been concealed in the mesquite forest that had grown up over them, perceptible at first sight, was a slight and gradual elevation above the surface formed from the gradually crumbling material. In the excavation work it was difficult to distinguish the walls from the material that buried them, being of the same color and quality of earth, and varying only in hardness. Therefore, the sense of touch was the determining factor in bringing them to light. One of the workmen, in his ambition to please by laying bare a goodly line of wall would habitually be led astray by his imagination and frequently show a considerable stretch of "*pader*" as they called the Castilian *pared* or wall, in their Sonora vernacular; but the test of a not over-vigorous kick from the foot of Mr. Cushing or Ramon, whose practised eye could detect that no wall belonged there, would bring the sham structure down into an ignominiously crumbling mass. The real walls would not yield to such an assault, but, after months of exposure to sun, wind and rain still showed the plans of the great blocks of buildings to which they belonged, often covering an area of an acre or more, and honeycombed into small rooms and narrow passages.

The domestic utensils would be found undisturbed in just the places where they belonged in a well-regulated Pueblo household, unbroken save by the falling walls or the weight of earth upon them. This fact indicated a deliberate abandonment of the place, under such a *taboo* as would be laid upon it by the priesthood in the case of a region made unstable and uninhabitable, according to their notions, by an earthquake or succession of earthquakes, such as Mr. Cushing found evidence of. Here, and nearly universally among all the ruins explored in this and the Gila Valley, the charred remains of the roofs were found. This might have happened by the roofs of earthquake-demolished houses falling in upon the hearth-fires, and communicated to the adjacent houses. The uniformity with which the roofs are everywhere burned, however, seems to militate against their destruction in this manner. It might have happened, however, that the whole region was overwhelmed by a savage horde like the wild and nomadic Apaches, who exterminated the inhabitants and burned their towns, or caused them to flee to other parts of the continent, possibly thus putting in motion the migratory movement southward that established the Mexican cultures. An investigation of ancient ruins at various stages southward in Mexico, beginning in Chihuahua and Sonora, as careful as that which has been pursued here, is of importance in settling these questions, for the conditions in which they were left, in comparison with those here, would tell much. It would seem that an invading horde would be likely to sack the houses and smash their contents. On the other hand, if the towns were left deserted they might remain unmolested even after the lapse of years, for the superstition of other tribes settling in the region would very likely prevent their venturing within the precincts of a place, much more across the thresholds of its dwellings, that had been abandoned because of divine disfavor, and over which still presided the powerful demons who would work harm to all who might be so rash as to defy them. But, whence, then, the universal conflagration that seems to have visited every one of these ancient towns? Possibly the departing inhabitants might have applied the torch themselves, making a final sacrifice of their abandoned homes in hopes of thereby regaining the favor of the gods for their new dwelling-places.

Beneath the floor of nearly every house are found buried at different depths and often in three successive layers the skeletons of members of the family that occupied it. The topmost skeleton was invariably that of a young person; on account of their immaturity, and also from the fact of being near the surface, these skeletons of the upper tier were in the worst state of preservation. It seems likely that, when the young persons of a household began to die the house was abandoned because of the misfortune that had come upon it, thus accounting for the fact that the last burials made in a house were those of young people. Another interesting fact was that it was the custom to bury an infant beneath the kitchen hearth. This practice of house-sepulture could not have been promotive of sanitary conditions, though, in this dry climate, the results would not be so disastrous as they might have been elsewhere. Mr. Cushing, while in Zuñi, was puzzled to account for the fact that graves were called the "houses of the dead," but the discovery of this custom of house-sepulture threw light on the subject. Ancient Pueblo skeletons have hitherto been very rare, for explorers, not suspecting the custom of house-sepulture, could not find where they were buried.

But a small proportion of the remains was disposed of by sepulture, for that was a privilege only accorded to members of the priestly caste or of the esoteric societies, whose control over the soul was believed to be such that they had no need of external aid to separate the soul from the body at death. The ordinary people were cremated, and the pottery vessels containing their remains were found buried near the bases of pyral mounds, or great heaps wherein were found the fragments of the personal belongings of the dead, burned with them to accompany them into the other world. These vessels in which the dead were buried were usually plain, while the food-bowls and water-jars buried with the skeletons exhumed in the houses were, for the most part, handsomely decorated.

In Mr. Cushing's paper on the evolution of Pueblo pottery, contributed to the Fourth Annual Report of the Bureau of Ethnology, the growth of form from primitive types was traced as clearly as is the course of development in a chain of species in natural history. Some of the types necessary to complete the chain were not to be found at that time, but he pointed out what they should be. All the missing types were found here in the course of these excavations, thus substantiating the correctness of his reasoning.

Owing to the nature of the soil, which is exceptionally rich and retentive of moisture, encouraging the penetration of the roots of vegetation to a considerable depth, and probably also to a great extent due to the antiquity of the remains, the pottery found here at Los Muertos is very tender, and falls easily into fragments, requiring particularly careful handling. Close examination of pieces freshly excavated will show how delicate little rootlets have wrapped their fine net-work all around them, and with their subtle acid extracted from the pottery some element that gave it cohesion. For the same reason the skeletons excavated here at Los Muertos crumble after exposure, so that it is almost impossible to preserve them, despite the utmost skill of Dr. Wortman. The potsherds found on the surface are as hard as when freshly burned. Both the pottery and the skeletons found at Las Acequias were much better preserved, owing to the more gravelly nature of the soil there.

Sylvester Baxter.

Destruction of an Ancient Norwegian Church by Fire.—The Næs Church, by the Lake Mjösen, in Norway, so well-known to tourists through its picturesque situation, was totally destroyed by fire the other day. It dated from the early part of the thirteenth century. The fire was caused by the carelessness of workmen.—*The Builder.*

THE LEAGUE EXHIBITION.—I.

NOW that the Annual Exhibition of the New York Architectural League has become an established factor in professional life, the first duty of the conscientious critic is to try to compare each year's collection of drawings with those of the preceding year, so as to trace, if possible, the tendency of a branch of American art which is unquestionably gathering strength and courage for undertaking a brilliant flight at no distant day, and to do what little he can to point out the stumbling-blocks which appear likely to be found in the way of true progress.

On the whole, the present exhibition cannot be called an advance upon the last one. The general character, both of the design and draughtsmanship, is better, and there is a notable absence of the monstrosities which in former years have disfigured the walls, but, at the same time, there are very few of the conspicuously beautiful examples, either of drawing or architecture, which do most to instruct and attract the public, and give the greatest value to an exhibition. Another thing that strikes the experienced spectator is that although the most renowned of the American designers are represented, their work is, as a rule, inferior to that shown by the same men in former years. We find still in the catalogue the familiar names of Rossiter & Wright, Lamb & Rich, John Calvin Stevens, Burnham & Root, Cass Gilbert, Babb, Cook & Willard, Brunner & Tryon, and a dozen others, but on going with pleasurable anticipations to examine the numbers to which the names are attached, we find in very many cases work bearing the obvious marks of having been principally designed by assistants, or "dashed off in a hurry," or "got through as rapidly as possible," or offering in other ways a very slender flavor of the talent which we once admired so much.

It is easy enough to account for this. The authors of the works which charmed us two or three years ago are now in the full tide of what their friends call prosperous business, and, instead of designing, have to spend their time in adding up, or rather, in subtracting from, plumbers', masons', carpenters', gas-fitters', plasterers' and painters' bills; in listening meekly to the objurgations of their female clients, who refuse to be comforted because their victim forgot which house was to have six shelves in the kitchen dresser and which was to have only five; or in rushing in terror a thousand miles across the country, because a disappointed local contractor has discovered that their church tower, in whose entasis they took particular pride, is "a bulgin' about a third of the way up," and the church committee, to whom he has communicated this information, have hardly been able to wait for the arrival of the architect with his explanation, before voting to displace him, and appoint a protegé of the contractor's in his stead. As for the older lights of architectural drawing, Stanford White, McKim, W. R. Emerson, E. C. Cabot, T. P. Chandler and others, we do not find them personally represented at all. Whether their omission this year to exercise their powers for our admiration is due to the fact that all their leisure time is consumed in cutting off interest coupons from their stacks of investment bonds, we cannot say, but, whatever the cause may be, it is none the less a misfortune for American architecture that the most capable and brilliant men in it, in the height of their powers, should be compelled by our system of practice to abandon personal work, and substitute the pale reflection of themselves which is obtained by "influencing" a corps of clever draughtsmen. We are not consoled for their absence from the exhibition by the appearance of a few new men of great promise, for, although it is pleasant to see young designers coming forward and developing year by year into skilful and accomplished architects, there is no art in which the process of development continues longer, and, if circumstances would permit, the men who delighted us by their designs ten years ago could do work now surpassing that as much as that surpassed the crude efforts of their student days.

Looking through the entrance-door of the large room in the admirable Ortgies gallery, we find the general coldness of effect of the black-and-white drawings relieved by spots of color judiciously dispersed about the walls. Many of these are furnished by the always interesting designs for stained-glass lent by the faithful friends of the League, the Tiffany Glass Company. This year we are glad to remark the absence of any sketches for stained-glass wainscots, and there is rather more variety than usual about the window designs. Some of these use nothing but pieces of opal glass, put together with the smallest possible modicum of design, so as to depend almost entirely upon the play of color in the glass itself for effect — a method of design which, both in theory and practice, we cannot help considering an abuse of a most beautiful material. Some of the other sketches show novel, as well as successful treatments of figure and decorative subjects, and the Tiffany Glass Company evidently does not intend to have the great art of glass-staining stagnate in its hands. The first black-and-white drawing that we come to is one of Mr. Pennell's *Century* sketches. Several others are hung about the room, and, of course, all are good, the best being perhaps the pen-and-ink drawing of Plantin's studio at Antwerp, well known by its publication in the *Century*. Near by are two pen-and-ink sketches of houses, one by Mr. W. A. Bates, and the other by Messrs. Lamb & Rich, both tolerably good, and a colored drawing of St. Mark's Church at Kansas City, by Mr. T. K. James, which is also pretty good. Then comes a very brilliant pen-and-ink sketch of the portal of Prince Otto Henry's Palace at Heidelberg, by Sidney L. Smith, This drawing is worthy of study by architectural draughtsmen for the perfection with which the shadows are rendered. We are accustomed to think of Mr. Ruskin as a visionary egotist, and, very properly, to warn our pupils against reading the "*Stones of Venice*," or the "*Seven Lamps*"; but there is one book of his, the "*Elements of Drawing*," which every draughtsman should own, and more than that, should utilize by thoroughly mastering every exercise in it. In this way, more rapidly than by any other method we know of, can one acquire the ready perception of delicate differences of light and shade, and the precision in representing them on paper, which form the foundation of good pen-and-ink drawing. Mr. Smith, however he formed his hand, has secured the evenness of shadow which is so hard to obtain, and which Mr. Ruskin's exercises develop so surely, and his drawing is a signal illustration of its value.

Number 8 is a pen-and-ink drawing done with liquid sepia, a medium which seems this year to be greatly in favor, and, with its near relative, the mixture of India ink and burnt sienna, revived from the grave in which it has lain for ten or fifteen years past, to have almost driven out the indelible brown ink which was once so popular, but, we believe, is not used in a single pen-and-ink drawing in the exhibition. The sketch in question shows very well the merits of the new medium, which is dark enough to give force, without the harshness and coldness of India ink; and although the design and the drawing are both rather thin, the effect is pretty. Next to this is a drawing in black ink by Mr. E. R. Tilton, purporting to represent "Bits of Italian Detail," of which we wish we could speak as well. Mr. Tilton is by no means a bad draughtsman, and his subjects are drawn from photographs, so that they might have been, and ought to have been faithful representations of some of the most delicate and beautiful sculptured detail in existence; but he appears to have thought that no one would notice trifling aberrations of outline, or oversights in regard to the proportion of pattern and ground, so that it was not worth while to take much pains; and the result is that his drawings are little better than caricatures, boldly rendered, but presenting nothing of the fine feeling which is the most valuable part of Italian work. Much better than this are his drawings of the Giraud-Torlonia Palace, and a lot of colonial doorways, Nos. 122 and 123, which are careful and good. Numbers 11 and 12 are in color, the first being a rough, but rather effective sketch by Mr. Taft, of a house which would be likely to be considerably less effective than the sketch, and the second a well-executed drawing of what looks like a parochial school, but turns out to be a Washington dwelling-house. The next number exhibits Mr. Henry Neu as a pen-and-ink draughtsman, in a competition sketch, made for Mr. R. H. Robertson, for the new *World* building, an effort which cannot be called particularly successful in any respect. Another pen-and-ink drawing in sepia, by Mr. Hubert Pierson, is intended to represent the door of Bourges Cathedral, but, like too many others, sacrifices conscientious attention to detail to a dash and effectiveness of drawing which would be tenfold more attractive if it accompanied fidelity to the lovely original. There are plenty of drawings on the walls which are quite as effective, as dashing and as sketchy as this, but which give such facts as they are intended to express with perfect faithfulness, the best among these, next to those by Mr. Kirby and Mr. Bacon, of which we shall have more to say hereafter, being perhaps Mr. Schladermundt's sketch in Venice, No. 88, and Mr. Schweinfurth's frame of little drawings, No. 140, the most careful of which are extremely good.

In No. 17 we arrive at the first example of a tribe of works which is represented in great force in this exhibition — unfortunately for the exhibition, and for those who cherish the idea that architecture consists of something more than colored blots on paper. This is not the worst of the lot, the most glaringly superficial and meaningless of them all, such as Nos. 50, 118, 154, 202, being attributed in the catalogue to that very clever architect, Mr. C. S. Luce. The last one is, indeed, signed, "C. Luce, Pinxit;" the tool used by the "Pictor" being apparently a whitewash brush, with which several puddly daubs of various colors have been slopped together into a sort of outline of a building, on which have been subsequently dropped some little blobs of indigo, which, we suppose, are intended to do duty for windows, although in two instances they appear on the outside of what are evidently designed to indicate chimneys. Of architecture in these works there is little or none. A rectangular wooden box surmounted by a clumsy roof, and furnished with shapeless windows at regular intervals is not an architectural object, even though one end of it may be yellow and the other red, nor does it help it to cloud the middle with green. On the contrary, such veils of chromatic haze would spoil the effect of the best piece of architecture ever designed, and on an ugly barn they simply increase the ugliness.

[To be continued.]

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSES OF MRS. J. J. FRENCH AND MRS. C. E. STRATTON, COMMONWEALTH AVE., BOSTON, MASS. MESSRS. ALLEN & KENWAY, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

STABLE FOR W. F. PROCTOR, ESQ., LORHADA, NEW YORK, N. Y. MR. W. ROSS PROCTOR, ARCHITECT, PITTSBURGH, PA.

CHURCH OF ALL SAINTS, PONTIAC, R. I. MR. HOWARD HOPPIN, ARCHITECT, PROVIDENCE, R. I.

PULPIT AND CHOIR IN THE KNEELAND MEMORIAL CHAPEL, TRINITY CHURCH, LENOX, MASS. MR. W. C. BROCKLESBY, ARCHITECT, HARTFORD, CONN.

RESIDENCE OF SENOR ENRIQUE CONCHA Y TORO, SANTIAGO, CHILI, S. A.

COMPETITIVE DESIGN FOR CALVARY BAPTIST CHURCH, DAVENPORT, IO. MR. WM. COWE, ARCHITECT, MILWAUKEE, WIS.

HOUSE FOR JAMES E. WAUGH, ESQ., CHARLTON HEIGHTS, D. C. MR. T. F. SCHNEIDER, ARCHITECT, WASHINGTON, D. C.

HOUSE OF MRS. ISABELLE NASH, BRIDGEPORT, CONN. MR. C. T. BEARDSLEY, JR., ARCHITECT, BRIDGEPORT, CONN.

A GENERAL PROTEST AGAINST IMPROPER CONDITIONS OF COMPETITION.

[Architects in every part of the country are invited to send us their authorization to add their names to the protest. — Eds.]

Boston, Mass., December 18, 1888.

THE Commonwealth of Massachusetts has, by its Commissioners, advertised for designs for the State-House extension, said designs to be furnished in open competition. The conditions of the competition, as announced, have evidently been framed without due regard to the best custom in the conduct of such matters, the sole end and aim of which should be to secure to the State the best service by making sure that "the best men shall take part; that they shall be encouraged to do their best; that the best they offer shall be selected; and that the author of the successful design shall be employed as architect, provided the building is built and he is competent."

The conditions announced are faulty —

First. In that they are not drawn up in accordance with the best custom, and no assurance is given that an expert adviser will be employed to aid the Commission in their choice.

Second. That no assurance is given that the successful competitor will be employed, but, on the contrary, it is distinctly stated that all premiated competitors are to relinquish all ownership in their plans to the State, without any further claim to compensation or employment.

Third. Even if the first prize in the competition were as it should be, the execution of the building, the actual prizes offered would still be entirely insufficient compensation to the authors of the drawings placed second and third.

For the above reasons, we, the undersigned architects, citizens of the State of Massachusetts [and elsewhere], protest against this form of competition, which, in our opinion, is not for the best interests of the State or of our profession, and we therefore decline to enter it:

BOSTON, MASS.
Cabot, Everett & Mead.
Wheelwright & Haven.
Joseph R. Richards.
John A. Fox.
Geo. H. Young.
E. A P. Newcomb.
Longfellow, Alden & Harlow.
Edwin J. Lewis.
Andrews & Jaques.
H. Langford Warren.
Walker & Best.
Wm. Rotch Ware.
Hartwell & Richardson.
Cummings & Sears.
T. M. Clark.
Allen & Kenway.
Rand & Taylor.
Thos. O'Grady, Jr.
Sturgis & Cabot.
Shepley, Rutan & Coolidge.
Rotch & Tilden.
Snell & Gregerson.
Shaw & Hunnewell.

BOSTON, MASS.
Wm. G. Preston.
L. Weissbein.
Franz E. Zerrahn.
Carl Fehmer.
Arthur Little.
Peabody & Stearns.
Winslow & Wetherell.
W. H. McGinty.
W. M. Bacon.
W. P. Richards.
Daniel Appleton.
H. M. Stephenson.
W. R. Emerson.
Wm. Whitney Lewis.
J. Merrill Brown.
Chamberlin & Whidden.
Wm. D. Austin.
F. W. Chandler.

HOLYOKE, MASS.
E. A. Ellsworth.
H. Walther.
Jas. A. Clough.
Geo. P. B. Alderman.
Cain & Kilburn.

HOLYOKE, MASS.
Henry H. Gridley.
W. E. Fitch, C. E.
D. H. & A. B. Tower.
T. W. Mann.

LAWRENCE, MASS.
Chas. T. Emerson.

LOWELL, MASS.
F. W. Stickney.
Merrill & Cutler.

LYNN, MASS.
Wheeler & Northend.
Call & Varney.
H. W. Rogers.

SPRINGFIELD, MASS.
Gardner, Pyne & Gardner.
Richmond & Seabury.
Jason Perkins.
F. S. Newman.
J. M. Currier.

WORCESTER, MASS.
Stephen C. Earl.
E. Boyden & Son.
Fuller & Delano.
A. P. Cutting.
J. B. Woodworth.

TORONTO, CANADA.
W. R. Gregg.

BIRMINGHAM, CONN.
Alderman & Lee.

BRIDGEPORT, CONN.
C. T. Beardsley, Jr.

HARTFORD, CONN.
M. P. Hapgood.
W. C. Brocklesby.

NEW HAVEN, CONN.
L. W. Robinson.

WATERBURY, CONN.
R. W. Hill.

WASHINGTON, D. C.
W. J. Marsh.
H. T. E. Wendell.

CHICAGO, ILL.
J. E. O. Pridmore.

BALTIMORE, MD.
T. B. Ghequier.
R. F. J. Johnson.

CEDAR RAPIDS, MICH.
Josselyn & Taylor.

KANSAS CITY, MO.
Willis Polk.

ST. LOUIS, MO.
C. E. Illsley.

ST. LOUIS, MO.
Eames & Young.
A. F. Rosenheim.

ST. PAUL, MINN.
Gilbert & Taylor.

EAST ORANGE, N. J.
S. W. Whittemore.

NEWARK, N. J.
P. G. Botticher.

ALBANY, N. Y.
Fuller & Wheeler.
F. H. Janes.

BROOKLYN, N. Y.
C. F. Eisenach.
M. J. Morrill.
H. M. Davis.

BUFFALO, N. Y.
Marling & Burdett.
R. A. & L. Bethune.
Green & Wicks.

ELMIRA, N. Y.
Pierce & Dockstader.

NEW YORK, N. Y.
W. B. Bigelow.
Fowler & Hough.
G. Edw. Harding & Co.
Rossiter & Wright.
W. A. Potter.
A. J. Bloor.
J. R. Hinchman.
C. P. Karr.
G. E. Harney.
J. C. Cady & Co.
G. M. Walgrove.
C. H. Israels.
H. M. Congdon.
Withers & Dickson.

NEW YORK, N. Y.
Babb, Cook & Willard.
H. H. Holly & Jelliff.
H. D. Hooker.
O. P. Hatfield.
G. M. Huss.
H. O. Avery.
C. W. & A. A. Stoughton.
W. H. Beers.
H. Edwards-Ficken.
H. R. Marshall.
A. H. Thorp.
L. B. Valk.
H. F. Kilburn.
J. A. Hamilton.
W. H. Mersereau.

ROCHESTER, N. Y.
J. R. Church.

SAYVILLE, N. Y.
I. H. Green, Jr.

UTICA, N. Y.
W. H. Symonds.

CINCINNATI, O.
E. Anderson.

PHILADELPHIA, PA.
Smith & Pritchett.
G. C. Mason, Jr.
Moses & King.
F. M. Day.
B. Linfoot.
J. M. Wilson.
H. A. Macomb.
Cope & Stewardson.
Hazlehurst & Huckel.
J. J. Deery.

PROVIDENCE, R. I.
Stone, Carpenter & Willson.

HEATING AND VENTILATING THE NEW COURT-HOUSE AT BOSTON.

Belfry of the former Cathedral Vaison Vaucluse.

THERE is no one type of apparatus, no complete system of heating or of ventilating, just as there is no one construction suited to all the varieties of building. Each building has its characteristic peculiarities and special requirements, calling for modifications in the heating and ventilating apparatus. In most cases, even of public buildings where ventilation is of paramount importance, the selection of the apparatus is likely to depend upon its possessing some one feature perhaps of great excellence in itself, but not necessary in any sense to the attainment of the result supposed to be peculiar to it, and not having a single one of the elements essential to producing the effects most appropriate and desired. These may have been taken for granted or overlooked altogether, because overshadowed by the undue prominence accorded to some detail of really secondary importance. It appears in this case as if the Commissioners, believing a certain type to be generally excellent, and having been shown some actual examples, impressive from their very magnitude (for that reason perhaps) had forthwith adopted it for the court-house.

Beyond the care shown in the preparation of the plans, for whose completeness the engineer deserves the highest praise, we think magnitude and the lavish use of iron in almost unlimited quantities, cast, wrought and galvanized, constitute the only merits of the design, if indeed it be a merit to cram the valuable space of a costly building with useless material, of which the whole excess is in fact, nothing but junk.

We propose to investigate the subject of heating and ventilating this building somewhat exhaustively, and, having determined the elements which should indicate the design, see to what extent they have had influence in the plans of the court-house apparatus. It is first essential to examine the conditions depending upon the construction and arrangement of the building, and, considering the use to which it is to be applied, to fix the requirements in accordance with established principles and within the capacity of modern engineering.

These data being ascertained, the next step is to design an apparatus that can, with least first cost but greatest permanence, most nearly attain the results aimed at, doing this with economy in fuel and maintenance, and ease and simplicity of management.

The degree of excellence which the apparatus will possess will depend upon the thoroughness with which the conditions and the requirements have been studied in all their aspects, the resources of the designer and his skill in securing indispensable results notwithstanding obstacles and unavoidable restrictions.

The apparatus should be capable of such a variety of effects as to set at nought the caprices of wind and weather, but the effects will not be secured if the means of producing them are lost in a multiplicity of details not readily accessible and scattered over a wide area. The arrangement should favor a reduction in the number and a gathering together of parts and making the details conspicuous, tending to concentration of management. A great number of parts,

either similar or different, involving endless repetition of adjustment, invites confusion. The control of all those elements from whose flexibility proceeds the adaptability of the apparatus to changing conditions, should be judiciously concentrated, and the operation of each part and the whole together be responsive to it.

It must be taken into account in the first place that there will be machinery to be run by steam-power; half-a-dozen elevators and possibly electric-lighting besides. Therefore a considerable amount of steam-generating power is required. Now, it is an important fact that the heating effect of the exhaust steam of engines, though less intense, is equal in quantity to that of live steam. Compared with live steam under pressure it is theoretically not exactly so, but substantially and practically no difference can be detected without the greatest nicety in the measurements. The significance of this is that a large element of economy may be availed of by utilizing this waste steam for heating.

There are two modes of transferring heat from a central source: in one, the heat conveyed by water or steam in pipes is liberated from the surfaces of radiators set in the spaces to be warmed. In the other, the heat is transferred by a current of air, which also may subserve the purpose of ventilation.

As between the two methods the latter is justly believed to be the more desirable, because with the heat there is supplied a continuous flow of fresh air.

In those cases, however, where a rapid change of air is of no consequence, this form of heating is needlessly wasteful. Let it be understood that if the temperature is to be kept at a fixed point, say 70°, the entering fresh hot air must displace an equal quantity at that temperature, whose heat is thus carried away by the outlet flues and lost.

The average winter temperature is near 32°; now if the air is taken into the heating apparatus at this temperature and heated to a point high enough to maintain the building at 70° (which is therefore the temperature of the air thrown away), then the loss by this system is measured by the quantity of air raised from 32° to 70° and continuously discharged. Supposing the air in this building to be changed once in fifteen minutes as would be the case with this unmodified system, the loss would amount in the case of the Court-house to the combustion of 571 pounds of coal per hour more than would be required to maintain the temperature of the building, and in cold and windy weather this loss would be disproportionately increased, owing to accelerated velocity in the flues, and consequent excessive flow of air.

The system, in mild weather when unlimited ventilation can be afforded, is almost stagnant; on the other hand, when severe cold indicates a restricted supply of air, the flow is excessive, and the apparatus is taxed far beyond the just needs of the building for both heat and fresh air. The use of the building will be such that a change of air need only be maintained during eight hours of each working-day; therefore during two-thirds of the time at least, change of air is not necessary.

It is plain then, that economical considerations demand that the heating should not depend upon the supply of fresh air; that the building should be kept warm by direct radiation, and that the air should be supplied in proportion to the demand for ventilation, sometimes more, sometimes less, and only heated to 70°. Being freed from the duty of transferring heat (except so far as it should be suitably warmed for introduction into inhabited apartments) the air-supply can be brought under exact control and the ventilation can be adapted to actual needs, be increased, diminished or stopped altogether, without in any way affecting the heating or being itself affected.

Thus the heating can be suited to the exigencies of the weather and the ventilation to the wants of the occupants, without interference. But if the two are inseparably connected, the joint apparatus will be worked chiefly with regard to the heating, which is indispensable, and the ventilation, as being of less importance, will be inevitably sacrificed and finally lost sight of altogether.

Next, as to the modes of heating: We have to decide between hot water and steam. It is important to cover a considerable range of temperature, and to secure flexibility or promptness of action. Of the two, the former is more important. Water-circulation affords a complete range of temperature, so that every variety of weather can be perfectly met. On the other hand, it is slow to change its temperature. Steam is much more quickly turned on and shut off, but acts within narrow limits. The radiating-surfaces, being calculated for the coldest weather, are excessive for all other times. As a rule, steam-heated buildings are too hot in mild weather, and not always warm enough in extremely cold weather; there is no provision for extremes, yet it is the extremes of weather which it is the very province and intention of a complete system to meet and nullify. No device for regulating the heat of steam-radiators has yet come into general use, and, in spite of the greater slowness of action, we must accept the hot-water system on account of its wide range of temperature. But there is another property of steam which we may make use of, which will enable us to save the waste steam of engines, and to secure a great economy of space and apparatus in the transfer of heat from the heating centre to the local heaters. We have found that we should use hot-water radiators, but it is not therefore necessary that the water should be heated at some remote point, and thence be slowly transferred to the distant radiators through ponderous pipes. The radiators can be heated locally by brass coils supplied with steam, and placed within and acting upon the water system at the base of the rising mains. Nothing can exceed the rapidity with which steam can transmit heat at great horizontal distances through pipes of but moderate dimensions, and with but slight loss of pressure and reduction of intensity. Next to its use in driving engines, this, the transfer of heat in great quantities economically, is its most valuable proprety, and we must not neglect it. There need be, then, no separate system of hot-water boilers, but only one type of steam-boilers, useful alike for power and heating, thus saving one set of fires.

We can take up next, having settled the heating, the question of fresh air, its quantity, distribution, and control.

The purest air contains 3 parts of carbonic acid per 10,000; in cities, the air contains 4 per 10,000; all agree that the air is still agreeable when it contains 6 per 10,000.[1] The amount of carbonic acid in the breath is about 5 per 100, besides other impurities of which it is the measure, or 100 times as much as in air usually thought fit to breathe. The quantity of air consumed by one man in an hour is less than 18 cubic feet, producing on an average 0.6 cubic feet of carbonic acid; whence, to keep this from increasing above 6 per 10,000, it is necessary to supply not less than 3,000 cubic feet per person per hour.[2] This must be the limit for small rooms, for the jail and the library. For crowded court-rooms, a greater degree of vitiation will have to be accepted, if not by the judge and jury, certainly by the spectators, for causes largely owing to themselves. But the air need not be so bad as to be noticeable, except to one coming in from the fresh air out-of-doors.

The supply of air should be proportionate to the number of occupants of the rooms as nearly as can be estimated, and provision should be made for increasing or diminishing this supply by simple means, and without affecting the heating.

Where the so-called indirect system is used, the only way to lower the temperature is by shutting the registers, and thereby arresting the ventilation, or by opening the windows and pouring cold air down the backs of the occupants; or, where a system of mixing-dampers is used, while there may be an approximate, but practically very imperfect, control of temperature, there is no control of the air. So, too, if there are numerous inlets for the air, the supply will be most irregular. Sunday, when the building is empty, it may be flushed with deluges of air pouring in from a hundred openings exposed to a furious gale; Monday it may be calm, and the ventilation inactive when the house is crowded. If there are dampers for the engineer to adjust when the wind is northwest, he can change the position of them all when the wind is southeast. At the next change of wind he will probably close them altogether, and take fresh air from the cellar, as is done in most of our city school-houses. There can be no system and no regulation under such conditions. The flow and quantity of air can be regulated and controlled by air-propelling machinery only, and should not be left dependent upon the accident of wind, or the manipulation of hundreds of dampers by several hundreds of people scattered all over an immense building, and acting without knowledge or agreement with each other. It is evident that a systematic ventilation demands effective means to regulate and control both the temperature and volume.

Besides the temperature and volume, the moistness of the air must be considered. Air contains the vapor of water at all temperatures, but its capacity for absorption increases with the temperature. For example, at 32° one cubic foot of air can hold two grains of water, while at 70° it can hold eight grains, although, being expanded by heat, it weighs less. But in natural air it is only at times saturated, its mean in this climate being 71 per cent of saturation, in England 81 per cent, while it varies between the unusual limit of 30 per cent, or extremely dry, and 100 per cent, or saturation, when it either rains or snows.

If we take air from out-of-doors at 32° and at 70 per cent of saturation, called its relative humidity, and heat it to 70° without adding water, having about 1.4 grains to start with, the warm air will only have about one-sixth of its capacity for water supplied, or 17° of humidity. This is not because the heating process has dried it, as is commonly supposed, but because, by rise of temperature, the power to absorb water is enormously increased. Air as dry as this is very disagreeable to many people; whether it is hurtful or not is an unsettled question. But it would appear that Nature would be a safe guide in the matter, and, if we moisten somewhat the air which we heat, we should only do what Nature does on a large scale. Here, again, we are restrained by practical difficulties. If the moisture is abundant, that is, if the relative humidity is high, the dissolved vapor will be precipitated as dew on cold surfaces, just as we see it in summer on pitchers of iced water. If the temperature of the inner surface of a pane of glass is 45°, and the temperature of the inside air is 65°, moisture will just begin to condense on the window-glass if the air is at 50 per cent relative humidity. There is no objection to this except in the case of exposed iron skylights, where condensation and dripping might be troublesome. Experience shows that the relative humidity may be kept up to 50 per cent in this climate, except in the most severe cold weather, without inconvenience practically, and with great comfort to many people.

Since the greater part of the time is spent indoors in winter, the question of moisture probably has an important part in the effects of the climate in this country, and more attention will hereafter be paid

[1] Angus Smith.
[2] Dr. Parkes.

to it. Where there is no ventilation, of course there need be no moisture provided, and it is only as ventilation becomes more prevalent that the subject of humidity will receive more consideration.

Its bearing on the climate is already being investigated, while its influence on the weather has long been established; but, as to climate, it is somewhat obscured by the other influences of temperature and sunshine, and not much knowledge has yet been reached. It is known, however, that the climate of Florida and of many other places much sought by invalids is moist; Nice has a humid climate, but at times, in spring, is almost intolerable, owing to the excessive dryness of the atmosphere. This dryness, which also prevails in spring in some localities on the coast of New England, is to this day popularly supposed to be a dampness, from its chilling effects, but repeated observation has established the facts as above explained.

Evaporation produces cold, because each little atom of vapor carries off with it a quantity of heat, and a dry air chills by its rapid absorption of invisible perspiration. To avoid chill, dry air must be rather warm; it should have a temperature so high as not to remove much heat from the body beyond what is carried off by the evaporation. A dry air at 80° is not too hot for many persons. If the cold produced by evaporation can be avoided, it is plain a lower temperature would suffice, and it is probable that a moist atmosphere at 62° would have the same effect on our sense of heat as a dry air at 75° or more, and is desirable for many reasons. The blood is not able to furnish an unlimited supply of water for perspiration, and probably the injurious effects of a dry atmosphere will be found to consist in such a rapid evaporation from the skin, while the body is at rest and the circulation slow, as to diminish the proportion of water in the blood of smaller vessels faster than it can be replaced by the circulation. This explanation is plausible; but, after all, exposure to dryness may cause no permanent harm, though to many it is a source of momentary discomfort.

The usual way of supplying moisture is by rapid boiling from a pan or hot surface. There are some objections to this, because the water contains organic matter and dissolved gases, some of which are decomposed and set free by boiling, and impart a smell to the air. There will be, however, a residue which is not driven off with the vapor, and which, by slow accumulation, makes the water very foul. Both of these objections are obviated by evaporating the water at a relatively low temperature, and by allowing it to flow through the evaporator in a constant stream, only three-quarters of it being evaporated. This part of the heating apparatus ought to be placed where it can be frequently inspected and seen to be in working order.

Having now considered the ruling elements with sufficient fulness to be able to outline a plan, and summarizing the results, we find that economy and efficiency require that the main heat-distributing system should be worked by steam; adaptability to regulation through a wide range of temperature determines that the local radiators should be warmed by hot water, which, as shown, ought to be arranged in detached circuits deriving their heat from a steam apparatus centrally placed; that systematic and regulated ventilation cannot be had without a mechanical propulsion of the air which should be susceptible of complete control at one point; that for the sake of comfort, the relative humidity of the heated air should be kept up, and, since this is evidently impracticable if the fresh air be admitted at many points, we have another reason for concentrating the entire control and treatment of the air in such a way that system in the management, prompt adjustment and regularity of working may be assured. We now know exactly what is requisite, and the proper means to obtain it. The question is, are these means within the reach of the architect and the Commissioners, and if so, have they availed themselves of them?

There are numerous examples in our own country as well as in Europe where these principles have been applied with complete success; where the apparatus was designed by engineers who not only appreciated all that is demanded by good ventilation and understood clearly what they were aiming at, but possessed the skill to so utilize their resources as to hit the mark with certainty. It is true that many of these examples are impaired by want of money, for none of them had the friendship of Government officials and a Government surplus to draw upon.

Before examining the proposed plans to find an answer to these questions, it would be instructive to determine for ourselves the quantities and the power of a heating apparatus suitable for this court-house.

The contents in cubic feet are 2,695,000 divided as follows: in rooms, 1,468,000; library, 132,000; corridors, etc., 1,095,000.

The area of external walls is in square feet 148,000; and of glass in windows and skylights, 25,800. Our figures are approximate.

The average loss of heat at internal temperature of 70° and external, 32° (the average of our winter climate), will be, according to Péclet and Box, per hour,

by walls,	148,000	sq. ft. at	8.3	units of heat	U 1,228,400
by windows,	25.800	sq. ft. at	19.75	" " "	509,600
by leakage of air,	200,000	cu. ft. at	0.64	" " "	128,000
Total loss of heat per hour in heat units,					1,866,000

Allowing that one pound of coal by its combustion yields only 8,000 units of useful effect, and dividing by this number the above total, we have the loss per hour measured in fuel to be 233 pounds of coal. This is the average loss. At 6° below zero, the loss would be double this, or 466 pounds if the cold should be continuous. But in this latitude, the cold seldom reaches so low a point and never remains there long, moreover, a massive building is not readily penetrated by it, so that if we provide for such a degree of cold, with an apparatus capable of meeting this extreme loss of heat we should have ample power and something over.

We have not considered the cubic space for the reason that it has no fixed relation to the loss of heat. It may help us to determine the quantity of ventilation.

If we change the air in the corridors twice per hour we have

	1,095,000 x 2	= cu. ft.	2,190,000
in the rooms, 6 times,	1,468,000 x 6	= "	8,808,000
in the library, once in 40 minutes,	132,000 x 1.5	= "	198,000
Total hourly change of air, cubic feet,			11,196,000

Or 186,600 cubic feet per minute.

The hourly consumption of coal to heat this air from 32° to 70° will be $\frac{11.196{,}000 \times 0.07. \times 0.24 \times 38}{8{,}000} = 893$ pounds, and the quantity at 6° below zero would be double this, or 1786 pounds,

The average heating effect then calls for the combustion of $233 + \frac{893}{3}$ (the ventilation being carried on only one-third of the time, eight hours in twenty-four) or about 530 pounds of coal per hour.

The maximum effect, which indicates the power of the apparatus, calls for 466 + 1786, or curiously enough, about 2240 pounds per hour. This is an extravagant provision, because it is very improbable that all the rooms will require full ventilation at the same time, and since at 6° below zero, the quantity of ventilation may be reduced somewhat, as in fact it always is, even sometimes to the point of shutting tight all cold-air inlets. But we intend to be liberal to extravagance, so that we cannot be accused of suggesting less than the real requirements of the case.

Above we gave some figures showing the quantity of air required per person for good ventilation to be 3,000 cubic feet per hour. In our arbitrary rate of change, we allowed for 11,196,000 cubic feet per hour, consequently we have provision for adequately supplying fresh air for $\left(\frac{11{,}196{,}000}{3{,}000} =\right)$ nearly 4,000 persons when the thermometer outside is at 6° below zero. This is more than generous.

The boiler power to fully convert into useful heating effect the above extreme and improbable use of coal is that of about 288 horses, reckoning a maximum combustion of 16 pounds per hour per square foot of grate-surface, and an evaporative efficiency of only 7.7 pounds of water per pound of coal, or 6 boilers of 48 horse-power each.

As we intend to utilize the exhaust steam of machinery for heating, we need make no provision for power, simply lending the steam to the engines before using it for heating, and thus getting the elevating and lighting-work done for nothing.

To transmit this heat by radiation from surfaces at a moderate temperature agreeable to the occupants, calls for about 12,400 superficial feet of radiating-surface in the local heaters whose duty it is to maintain the temperature of the building, and for heating the air distributed for ventilation, a central coil of pipes, containing about 8,000 square feet, very compact and efficient.

For moving this air, one fan about 14 feet in diameter running at 100 revolutions per minute and an engine of 30 horse-power would be required. Two smaller fans and two engines would be better, forming a duplicate apparatus, and there ought to be a separate fan for the jail. In the system here outlined, if the heating-plant should be disabled, the heating could be continued by the power-plant and ventilating-apparatus, and vice versa, and the business of the courts need not be interrupted.

To have sufficient power even above the improbable maximum demand, we should increase the boilers by one-third; as the radiating-surfaces may be subject to disadvantages of location, arrangement or construction (such as being massed too much together) we should increase them liberally, and also provide a surplus so that if the building should have become chilled, the apparatus can recover the lost ground rapidly. Let us double the heating-surfaces: We now have 6 × 1.33 = 8 boilers of 48 horse-power, and 12,400 × 2 = 24,800 square feet in radiators and 8,000 square feet in the main coils for heating fresh air, making a total heating-surface amounting to 32,800 square feet. We also need three blowing-fans, with their engines, to force the movement of fresh-air, evaporators, and probably three fans to insure positive movement in the ventilating-flues if they are tortuous and very unequal in length and frictional resistance. The exhaust-fans should be run by electro-motors. It is to cost nothing for power to run these fans. There should also be a small fan to expel heat from the boiler-room in the summer, to prevent it and the odor of hot-oil from machinery from passing into other parts of the building.

These, then, are our estimates of the boiler and heating power required by the Court-house, and arrangements similar to those we have described for insuring the ventilation we think not only desirable but indispensable to a good result.

We have only sketched an outline, but, in general, our apparatus, besides being capable of the effects which we stated to be necessary at the outset, and which we think will command unquestioning

assent, would possess this important quality, the entire control of temperature by the occupants of the rooms or persons in charge of them, without reference to the ventilation; there need be no opening or shutting of registers in attempts to regulate the heat, and no uncertainty in the supply and removal of air. If it should be too hot or too cold, the remedy is in operating the local radiators; but the ventilation should and could go on absolutely without reference to temperatures in the building, for, as stated among the essentials in our enumeration of the effects to be obtained, this air would be delivered in all parts of the building at a constant temperature, say 70°, which, if the rooms were colder than that, might add to their heat up to that point, but could by no means make it greater. Thus the engineer's duty would be extremely clear and easy for him to perform; and if the control were properly concentrated, he could have no excuse for unsatisfactory results anywhere.

We are forced to admit that in many cases neither has the managing engineer any clearly defined duty beyond keeping the building as hot as he can, nor the means of doing much else than this.

We believe that our conclusions cannot be shaken by any evidence obtained from the actual use of any type of apparatus; on the contrary, that it is founded on correct principles and supported by the best experience and practice the world over, except in Great Britain and districts controlled by the architectural bureau of the United States Treasury Department; that it is strictly in line with modern progress, and within the capa ity of modern engineering.

Let us see to what extent the proposed apparatus is conformable to them.

The Commissioners' engineers specify (12 hot-water and 2 steam =) 14 boilers of 45 horse-power each; about 30,382 square feet of direct and 57,240 square feet of indirect radiators, or a total of 87,622 square feet of heating-surface, besides a large amount in ventilating-flues designed to insure a draught. There are no fans. There is no provision for moisture; no utilization of exhaust steam for heating. There are no less than 195 cold-air inlets exposed to all points of the compass, to be operated, in addition to as many sets of valves under varying conditions, by an indefinite number of occupants of the rooms, of whom there is no guaranty that a single one will be an expert in ventilation. There are 74 cold-air dampers, 32 switch-dampers and 64 mixing-dampers, all to be operated at every change of wind and temperature by the efficient corps of supernumerary engineers under the supervision of a skilful chief, probably a graduate of the Signal Service of the United States Treasury Department, who will issue hourly bulletins, with maps, indicating the probable climate for the ensuing hour in various parts of the structure, for the guidance of his subordinates and consolation of the inmates. Far from centralizing the control, the care of all these confused and differing subdivisions is scattered all over the building in dark, inaccessible flues, ducts and tunnels obstructed by enormous pipes, and all this mass of material, the larger part of which must, on account of its unsuitable arrangement, remain forever inert and worthless, is to be buried up in masonry, in whose construction 600,000 bricks are actually specified to be consumed, besides many tons of cast and galvanized iron.

A large part of the apparatus is exposed to certain damage from freezing in case of neglect to manipulate the valves and dampers properly; and it is so built-in within walls and metal casings as to make the repairs resulting from such accidents very costly and annoying.

The main pipes are to be covered with felting of cow's hair, which, after a year or two, will be rotten or moth-eaten;—some of this is in the fresh-air ducts, where it will contaminate the air.

As to the excessive boiler-power and the enormous surplus of heating-surface, it won't do to try to substantiate the correctness of the estimates by reference to Government buildings. In these it can be shown that the power of the apparatus is so far beyond the requirements that large quantities of material have been from time to time removed, and much more is never used, that in none (except where improved methods have been added) is there any systematic ventilation; that in many the cold-air inlets are permanently closed, and where the dampers fit imperfectly, paper is pasted over the registers or screens to prevent the wind from blowing documents off the tables and desks, the heating-power being so excessive as to heat sufficiently through the casings with the open-work screens thus closed.

In the Government buildings in New York and Boston where this system is used, these dampers are all permanently fastened up; some of the outer gratings have been closed by solid plates of cast-iron; in the Boston Custom-House, where a new apparatus of similar design has recently been placed, the wind blows straight through the building, in at one side and out at the other, carrying away out-of-doors heat intended for warming the interior, and, unfortunately, not available for heating neighboring buildings.

The same unsystematic arrangements for supplying air have been inflicted upon most of the Boston public schools, largely under the administration of Mr. Clough, the Court-house architect. Out of many reports made by sanitarians and health-inspectors upon the condition of these buildings, we select the most recent, of which the following is a part, by a prominent authority:

"From the reports of the inspectors, I fail to find the standard reached even in the best-ventilated buildings of the city of Boston; and in a large number of the older buildings (especially those occupied by the primary department of the school) the deficiency is startling, the condition of air being such that no test is required to prove its unfitness for respiration, and danger to the teacher and pupil occupying the building. In many buildings we find no provision even for fresh-air supply, and in others the supply is through the cold-air boxes leading to furnaces, where, as a rule, they are entirely inadequate, and not infrequently are partially or entirely closed. In the class of buildings heated by steam, by what we call the indirect system, we find the best provision for air-supply; but even that, with scarcely any exception, comes far short of the standard adopted, and the supply for the different rooms is irregular, and materially affected by the condition of the temperature and wind outside. A very general and almost universal deficiency is in the size of the fresh and foul air flues, which are found so small as to require a very high velocity in order to accomplish the necessary work. To illustrate, it is rarely that we find more than two supply-pipes to a room, and these are not over fourteen inches in diameter. To get the amount of air required for fifty-six pupils through these pipes would call for a velocity of 1,309 feet per minute, which is not obtained. The same deficiency exists in the foul-air flues, and it is not infrequently the case that the inspectors have found no movement of air whatever in these flues."

To return to the Court-house plans, we assert that they contain no internal evidence of careful study of the conditions, or of design to effect a single result beyond the certain overheating of the building. In fact, we can with difficulty refrain from the thought that the only design is to effect a sale to the County of a vast amount of material, leaving to accident all the essentials of comfort and health, to obtain which these Commissioners were appointed, and for which mainly the edifice is to be constructed. Certainly, without them, no perfection or magnificence of architecture will be a compensation.

Perhaps, as the county has gone so far as Baltimore and Washington for a type of apparatus, we may go still farther for evidence to prove its worthlessness. It so happens that there is an example of the greatest historical value, which has established for all time the comparative merits of the accidental system of ventilation which our Commissioners have adopted and the designed and regulated system which has alone yielded positive results. We refer to the Hospital Lariboisière (du Nord), in France. About 1848, the commission having charge of the construction of this hospital accepted without competition plans for heating and ventilation prepared by an influential house in the trade. Fortunately, the Council of Administration of Public Assistance of the State vetoed this arrangement, and required the commission to obtain a report by competent experts upon the proposed plans, together with other propositions from parties of high reputation as engineers. The examining experts reported unanimously in favor of one of the new plans, but the commission, under pressure from high quarters friendly to the former proposers, decided to give one-half of the hospital to them, and one-half to the successful competitor. Both apparatuses were finished in 1854, and began work the following year. In the third volume of "*Péclet's Traité de la Chaleur*," edition of 1861, will be found forty pages of matter devoted to this hospital, containing the able writer's own criticism upon the several plans, and embodying the report of M. Grassi, pharmacist resident at the hospital. In this report, the results of accidental ventilation compared with regulated ventilation are fully set forth in tabulated statements compiled from careful observations regularly repeated and continued, and confirming, after extended use, the views of the Board of Engineers who had reported unanimously in favor of the mechanical system of MM. Thomas and Laurens, amended by M. Grouvelle's hot-water apparatus, wherein the local hot-water heaters were joined in short circuits heated by steam. This brilliant idea had already been successfully applied at the great Mazas prison.

The latest example of this kind of work which we have seen is that at the Hôtel Dieu (City Hospital), Paris. In this immense institution the entire heating and cooking are done by steam from two boilers of about 50-horse-power (we speak from memory), the hot-water radiators being run by steam-coils. The two main pipes are of copper beautifully fitted, all angles being turned by arcs of circles of long radius. They appeared to us not over three-and-one-half or four inches in diameter. Those in the Suffolk County Court-House are proposed to be thirty inches in diameter.

We confess that the heating effect of an apparatus in Paris should be considerably less than here, and that there is no hospital in France (except those which are ventilated by windows kept permanently wide open, as in England also) which is adequately ventilated. We believe this to be due to the extreme economy of the French people, and to the fact that until the recent researches of Dr. Angus Smith and Dr. Parkes in England, and Professor Pettenkofer in Germany, the quantity of air needed for good ventilation was not appreciated. The apparatus of the French engineers has not failed to yield the calculated results. If there still exist deficiencies, they are due to the real requirements not having been known and stated in the first place, as we, from later knowledge, are able to state them now.

Another great building, the Hôtel de Ville in Paris, of which we have examined the heating and ventilating plans, but which was not complete at the time of our visit, is ventilated also by the mechanical system, the local heating depending upon steam-radiators so constructed as to retain the water of condensation in very large quantity, thus gaining the supposed advantage of a reservoir of heat remaining in the water after the steam is shut off, and utilizing this property of the hot-water system, apparently in the mistaken view

that it is the most valuable one. In our opinion, this is a decided defect in a heating apparatus, and the very and only objection to hot-water heating.

Péclet, the greatest investigator, and, at the same time, highest practical authority on heating, prefers steam-heating, pure and simple, with mechanical ventilation, to all else, owing to its rapidity of action, and when a great range of pressure is permissible, to its corresponding range of heating effect. But later experience goes to show that there are objections to using high pressure in steam-heating, and, consequently, its action is confined within narrow limits. No way of imparting to hot water the quick action of steam, or of constructing a steam-apparatus possessing as great a range of temperature as hot water, has yet come into established use. Either system would be perfect with the attributes of the other, but the world yet waits for their successful union in practice.

Regarding the Johns Hopkins Hospital, which the Commissioners visited, and where the basement is crammed with apparatus for heating and ventilation, and where, if they were merely in search of something calculated to astonish by magnitude and quantity, they certainly found what they were looking for, it should be told that the apparatus (fans and all) was confessedly experimental. The physician who is supposed to be responsible for it, though a learned and able writer and student, not possessing the knowledge, training, or experience qualifying him to design a practical apparatus, arranged with the Commissioners' firm to furnish one on a ten per cent commission, he making suggestions borrowed from books and observations of travel. It is plain to see that both parties to this contract were interested in multiplying the real requirements by some factor, the doctor's being a factor-of-safety (to him), and the contractor's a factor-of-profit.

For doing this work and that of the Government buildings, which by influence (the chief motive power in Washington) are alleged to have been turned into the hands of the same firm which the Court-House Commissioners have employed, many costly patterns and special fittings were required. It is claimed that many of these specialties are called for in the plans for our Court-house, and that the firm who prepared the plans have thereby handicapped all competitors against them for the work by a preference amounting to many thousands of dollars in their own favor. This would seem to have some color, for the reason that some very desirable fittings purposely designed for water-heating, and increasing the efficiency of the circulation, but not handled by this firm, are not specified, named, or shown in the plans.

It has begun to be known that the Commissioners are not likely to get many bids. They must expect that there will be but few, and perhaps collusion between the competitors, and that, consequently, the evident enormous cost of the proposed scheme may be forced up to the point of exhausting the financial strength of the County, which, left weak and helpless, will sink down under the tremendous weight unloaded upon it under this cover of an alleged apparatus for heating and ventilating the new Court-house.

We have a parting word to add: We hope the many thousands of dollars (as much as $30,000?) spent in changing and adapting this building into a storehouse for this apparatus, and the space sacrificed, will not prove to have been wholly thrown away. We think that the Commissioners' expert house of contractors and engineers can afford to give up the $4,000 they are to receive for services in specifying their own materials, and pay $10,000 for the monopoly and privilege thus accorded them. We think that they ought to do it. Suffolk County, in Massachusetts, will then have reason to be doubly grateful to them, and be better able, with this legacy in reserve, to keep in repair the monument with which, at her expense, they propose to perpetuate their memory.

Engineer.

M. DIEULAFOY'S DISCOVERIES AT SUSA.

THE new attraction at the Musée du Louvre in Paris is the Susa Gallery. Directly above the Salle Assyrienne a handsome and spacious apartment has been fitted up for the purpose of holding the marvellous specimens of Achemenidan architecture and Achemenidan art which M. Marcel Dieulafoy has dug up out of the mounds that cover the site of the ancient capital of the Persian Empire. After two years spent in arranging the collection — a task that, for reasons which will become apparent in the course of this article, involved unusual difficulties — the gallery is now thrown open to the public.

It was in December, 1884, that M. Dieulafoy, accompanied by his talented wife, Mme. Jeanne Dieulafoy, and two assistants, Messrs. Babin and Houssay, left Paris, intrusted by the French Government with an archæological mission. The extensive mounds which were the immediate goal of the expedition had attracted the attention of travellers for many years. As early as 1851 Sir William Loftus visited the village, which still retains the ancient name of Shus, or Susa, to the north of Dizfoul, in the south-western corner of modern Persia, and made a careful examination of the mounds at that place. He found unmistakable proofs of the existence of ruins beneath these vast accumulations of dust and rubbish, and hoped to induce the authorities of the British Museum to undertake excavations on a proper scale. But the archæological interest was at that moment centred upon the mounds, similar in character and formation, on the banks of the Tigris and in the valley of the Euphrates. A few years before, the Frenchman, P. E. Botta, had astonished the world by unearthing the palace of King Sargon at Kharsabad, and Sir Austen H. Layard, following close upon the heels of Botta, created a veritable sensation by the discovery of old Nineveh, with the palaces of several Assryian kings. A second French expedition was about to be sent into the field, and Sir Henry Rawlinson was busily engaged hunting for the "foundation" records of Nebuchadnezzar at Birs Nimroud. Thus the glory of resuscitated Nineveh and of reawakening Babylon threw everything else into the shade for the time being, and Susa was destined to be neglected until the worthy compatriot of Botta took up the spade. M. Dieulafoy was particularly well fitted for his task. Extensive travels in Persia made some years before had made him thoroughly familiar with land and people; prolonged studies in Persian art, of which his five volumes on "*L'Art Antique de la Perse*" are the fruit, had secured for him a high rank among archæologists, while his practical profession as an architect and his long experience as "Ingenieur en chef des Ponts et Chausées" in Paris gave him additional advantages, which were no small factors in his success.

Arrived on the spot, M. Dieulafoy encountered the same opposition from the natives which all explorers in the Orient have had to face, and this despite the firman with which he was provided. The fanaticism of a Mussulman populace, fanned by the agitation of a still more fanatical clergy, form a combination which it is exceedingly difficult to master, and when to this front be added the intrigues of officials greedy for bribes, one is surprised to find that Dieulafoy should have succeeded at all in carrying out the object for which he came. In reading his narrative, one is struck more particularly by the close analogy existing between the vexations which he had to endure and those which rendered Sir Austen Layard's life miserable during his sojourn in Mesopotamia some forty years ago — another instance, and a very unsavory one, of the well-known Oriental conservatism. Mohammedans are taught to look upon every scientific effort not bearing directly upon their religion with a contempt not unmingled with dread. To resuscitate, accordingly, the "buildings of the infidels" is both impious and dangerous. Hence every attempt at any kind of excavations in the East is frowned upon, and it is only in the face of the indomitable spirit of a Layard or a Dieulafoy — aided by a sufficient quantity of baksheesh — opposition in the end is forced to give way.

The half of February had gone by ere Dieulafoy sighted the mounds of Susa. Every day was of the utmost value to him, for in a few weeks the approach of the hot and rainy season would compel him to interrupt his labors. Fancy, then, his exasperation when, in response to an appeal for workmen, despite the prospect of good pay, three men and a child presented themselves. To add to his impatience, the Governor of the province, with a coolness that challenges admiration, wrote to Dieulafoy, in reply to his demand for assistance, that it would be better for him to desist from stirring up the prejudices of the population, and, assuming a tone of concern for Dieulafoy's safety, he suggested that Dieulafoy leave his baggage at Dizfoul and pay the Governor a visit at Schuster, when they might at their leisure talk over matters. Dieulafoy was not long in suspecting the Governor to be in league with the opposition. The existence of graves in the mound was a further weapon in the hands of his opponents, and the clergy were particularly loud in their denunciation of this profanation of the soil. The same cry was raised when Layard started to dig at Nimroud, and it was afterward ascertained that the Governor of Mosul had given secret instructions to remove tombstones from an existing cemetery and plant them in various parts of the mound at Nimroud. The graves at Susa seemed to be of a more genuine character, but Dieulafoy showed that they were the graves of the "infidel" Parthians not of believers. The appeal to consistency was probably not of much avail. What enabled him to conquer in the end was his dogged obstinacy. He simply would not "go." He remained on the spot, despite the alluring invitation of the Governor, and devoted himself to quieting the fears of the populace, who were told, among other things, that the Frenchman had come "to spy out the nakedness of the land." By degrees workmen came, and the work of digging could be begun, Mme. Dieulafoy herself setting the example by striking the first blow with the pick. It was not long before Dieulafoy was able to determine with tolerable certainty the nature and extent of the remains which the mounds contained. Trenches were opened at various points, a wall encircling a building of vast proportions was traced, and it was ascertained that the edifice in question must have consisted of several and sharply-marked divisions. Bricks bearing cuneiform characters were found, which made it clear that the edifice was none other than the palace of Artaxerxes Mnemon, or Artaxerxes II, the seventh monarch in the Achemenidan dynasty, who ruled over the Persian Empire from 406 to 359 B. C. Short inscriptions found by Loftus in the course of his examination of the mounds had also borne witness to the fact of a palace having been constructed at Susa by this same Artaxerxes. Dieulafoy's thorough knowledge of Persian architecture, as exhibited by the ruins at Persepolis and elsewhere, aided him in fixing upon the general distribution of the

apartments of which such a palace was composed, and he now devoted himself more especially to that portion of it where he conjectured the grand reception or "throne" room to have been situated, and which promised a particularly rich return. His expectations were not disappointed. The trenches being widened, they came into the "throne" room itself, where hundreds of glazed tiles in various states of preservation still bore witness to its former glory. Each tile, as it was taken out, was carefully numbered, and upon piecing them together it was found that they formed part of a large frieze representing a series of lions, whose fierce look, as they stand to-day in the Louvre, still is well calculated to inspire terror. These glazed tiles constituted the decoration of the palace walls, corresponding to the alabaster slabs, which was the ordinary material employed by the Assyrian kings in their palaces.

It may be imagined into what ecstasies of joy this discovery threw the Dieulafoy party. But still greater surprises were in store for them. From other sources, it was known that Artaxerxes had erected his dwelling on the ruins of an older building, which had been the work of his predecessor Xerxes, which had been destroyed by fire. Upon digging below the foundations of the "Apadana" of Artaxerxes, as this "throne-room" of the palace was called, M. Dieulafoy actually came upon abundant traces of this older building. Indeed, the glazed tiles found here form perhaps the most brilliant pieces in the "Susa" collection. Upon entering the gallery in the Louvre the first thing that will strike the eye of the visitor are the enormous friezes to the right and left of the entrance, showing a procession of archers. These friezes once graced the walls of Xerxes's palace, and what is most remarkable about them is that now, after a lapse of 2,000 years, they have been restored to view, the coloring on the tiles is almost as fresh and as gaudy as though the glazure had been put on within a few years. Specimens of glazed bricks have been found beneath the mounds both of Upper and Lower Mesopotamia which date probably from a period anterior to the conquest of the country by Persia, and there are reasons for believing from traces of coloring found on the slabs of the Assyrian palaces that the scenes sculptured on them were painted in many colors, but the art of glazing could never have been carried to that perfection in Babylonia and Assyria as was the case in Persia under the Achemenidan dynasty. Here results were obtained which were simply marvellous, and which have never been surpassed since. Dieulafoy began his archæological studies with the avowed purpose of finding the source for the brilliant decoration which plays so prominent a rôle in Arabian architecture, and here in the palaces of Artaxerxes and Darius he found not only this but also the prototype for much of the art that through the Arabs has come down to us. Herodotus speaks in his history of the guards of archers known as "the immortals," who were in constant attendance upon the Persian king, and Dieulafoy is of the opinion that the men on the friezes are intended as a representation of this body-guard. Another interesting question raised by the discovery is an anthropological one. Upon placing the scattered tiles in position it was noticed that there was a difference in the coloring of the hands and faces. While some presented the complexion common in the Orient, others were of a decidedly black hue, pointing apparently to an African origin. Have we here traces of a black race that once flourished in this region, and to the existence of which a number of other circumstances would seem to point, or did the Persian kings import these men from the other side of the Red Sea? Professor Houssay, one of the members of the Dieulafoy expedition, is at present engaged in studying this important problem.

It will now be clear why the work of arranging the collection which Dieulafoy brought along involved such an expense of time and labor. The thousands of tiles had each to be carefully examined and the position of each to be accurately determined. Naturally, upon placing them together, both in the cases of the archers of Darius and of the lions from the apadana of Artaxerxes, there were gaps everywhere. In order to furnish the visitor with a vivid picture of the actual appearance of the friezes in the palaces of the Achemenidans, M. Dieulafoy went to the great trouble of restoring the missing portions in following most faithfully, as a matter of course, the original designs. He has been severely criticised in some quarters for this attempt, but, as I believe, unjustly. The student of art will not be led astray by these restorations, which, moreover, are conscientiously indicated on a drawing placed at the side of the friezes, and the layman will certainly carry with him a far clearer and withal faithful impression of old Persian art than could possibly have been the case with merely a confused and imperfect lot of glazed tiles before him. What deserves more justly to be criticised is the arrangement of the tiles in the friezes of the archers on which cuneiform characters are inscribed — in the same brilliant colors — and which are evidently misplaced. As they now stand they give no sense whatever, and all that can be recognized is the name of Darius. Besides, it is more than likely that the inscription was beneath the pictures of the archers, as is generally the case on Assyrian slabs, and not between the pictures, as Dieulafoy seems to believe. The vestments of the archers call for special notice. The short tunics fall in graceful folds over the shoulders, and the variation in the patterns of the garments adds materially to the effect produced.

Let us return to the field of excavations for a moment. With the approach of the hot season the Dieulafoy party deserted their camp, but early the following winter they were on the ground again. Things went more smoothly now, though there was still an opposition to contend with, and already in December work was recommenced at the mounds. By the end of the season the funds at the disposal of Dieulafoy were exhausted, and he was obliged to close his labors. His success during the second season was not less significant than during the first. Among the discoveries made there is only room here to mention the wall supporting an enamelled brick staircase. Mme. Dieulafoy claims this piece as her particular share of the discoveries, for she was the first to literally stumble over it, while engaged in digging a large piece of the wall that now occupies a post of honor in the Susa Gallery, and a most gorgeous piece of workmanship it is. The design, consisting of a series of rosettes, is delicately executed, and, as in the case of the friezes, blue, green and yellow are the predominating colors. With the whole palace fitted up in the fashion of which the friezes and the staircase may be taken as samples, the effect must indeed have been startling in its grandeur. Dieulafoy also brought along portions of these enormous columns of solid stone which ran in the form of a colonnade around a wing of Artaxerxes's palace. The longest of these is over 17 feet high, but the calculation is that in their perfect state they measured over 30 feet with a circumference of about three feet. The style of the column is distinctly Ionic, but it is spoiled by a grotesque figure of a double bull worked in bronze which surmounts it. The combination, inartistic though it be, is exceedingly instructive as illustrating the attempt made by the Achemenidans to combine two wholly different species of art and architecture. The idea of the columns is a direct importation from Greece, if they are not indeed the work of Greek workmen brought over into Persia for the purpose, a supposition which appears to be borne out by passages in the works of some ancient authors, while the bulls are borrowed from the Babylonians and Assyrians, in whose architecture they occupy, as is well known, so essential a place. It is quite impossible to conceive an Assyrian palace without the bulls in various shapes and forms guarding the approaches to the palace chambers. The combination of Greek with Babylo-Assyrian art has produced the monstrous creation above referred to. It would appear from this that the originality of the Persians in their art was confined to their methods of glazing and enamelling, and it is probable also that not only in the construction of their edifices but also in their inner disposition of the various quarters they followed foreign models, in the first instance Assyrian models.

Thanks to the attainments of M. Dieulafoy as architect and civil engineer, he has been able to ascertain the relative position of the various quarters of which the palace of Artaxerxes was composed, with tolerable accuracy, despite the fact that he has only excavated what is in reality a small portion of the edifice. From the plan which he has drawn up it appears that the palace consisted of three distinct wings, the "apadana," or public reception-rooms, the harem and the apartments of the King. Included under the latter were the rooms set aside for the royal attendants as well as for the immediate family of the King. A wall ran around the whole edifice, and as an additional protection for the sacred person of his Majesty, the two entrances leading to his apartments, the position of which was admirably chosen with a view of securing exclusion combined with safety, were guarded by sentinels kept posted there. What adds to the interest of M. Dieulafoy's discovery is the remarkable agreement to which he himself has called attention between the references to the palace of Ahasuerus in the Book of Esther and the very building which he has unearthed. The three wings just referred to are distinctly mentioned by the biblical author under their proper designations as "bithan," which corresponds to the Persian apadana, the "house for the women," which is the harem, and "the house of the King," which represents the third quarter. Moreover, the position of these three quarters tallies with the picture of the palace which we would necessarily form had we the Book of Esther alone to guide us. Adjoining the bithan or apadana was the harem, and immediately to the south of the latter were the royal apartments, the three forming together an inverted letter L. The Book of Esther, it will be remembered, opens with a magnificent description of the festival which King Ahasuerus gave in the bithan, and is worthy of note that in the delineation of the splendors of the palace the colors of the draperies singled out for special mention are the very ones which appear most prominently in the decoration of the friezes and the staircase. Again the scene where Queen Esther approaches his Majesty becomes all the more vivid now that we know that the King's throne was stationed at the back of a hall in the centre of his apartments facing a corridor which led into the harem. He was so placed, accordingly, that he could see any one approaching from quite a distance, and could, by raising his sceptre, indicate that he granted the visitor permission to step before him. There was a second entrance to the King's rooms by a fortified gate to the left, and it is by this gate that the King's minister, Haman, is represented in the book as coming to the King. The terms used to denote these small details are all so exact that the conclusion is well-nigh forced upon us that the biblical writer who, it will be recalled, places his narrative in the city of Susa, must have had before him the very building which Dieulafoy has found, and it is in accord with the general conditions reflected in the book to suppose that it was written at Susa during the reign of Artaxerxes.

I have only spoken above of the large objects in the collection, but there are hundreds of smaller articles that might be mentioned. M. Dieulafoy shipped in all 70 boxes from the scene of his labors to

Paris; among these many handsome jars and vases, several hundreds of seals and cylinders, numerous ornaments of a miscellaneous character, and — what is particularly valuable — about 20 large unglazed terra-cotta tiles in a good state of preservation. These tiles are covered with inscriptions in the cuneiform character, and when they come to be deciphered, as no doubt they soon will be, our knowledge of the occurrences in the reign of Artaxerxes will be still further increased. There are good grounds, too, for believing that with the continuation of the excavation still further inscriptions will be brought to light. Indeed, it must be borne in mind that Dieulafoy has, after all, only made a beginning with the great mound at Susa. The results obtained are the more marvellous because of this fact, but the hope is expressed on all sides that the French Government will enable its distinguished citizen to continue the important mission which he has so successfully begun, and for which he has shown himself to be so eminently fitted. A countryman of Dieulafoy, Ernest de Sarzec, who spent several years digging at Tel-loh, in Southern Mesopotamia, has shown that it is far more advisable to confine one's efforts to exhausting, so far as possible, one mound, rather than what so many of the predecessors of De Sarzec have done, and superficially work over a large territory. — *Morris Jastrow, Jr., in the New York Times.*

COMMUNICATIONS

THE AMERICAN ARCHITECT SCHOLARSHIP.

Boston, Mass., January 7, 1889.

To the Editors of the American Architect: —

Dear Sirs, — The architect in whose office I worked for three years, was a member of the American Institute from 1858 to about 1867. Would the fact that he resigned in the latter year prevent my competing for the Travelling-scholarship next June?

Yours, Draughtsman.

[No. The reason for formulating the condition which has given rise to this question was merely to make sure that applicants had received a certain minimum amount of good training and so to lighten the labor of the examiners by ruling out those who probably had had less. — Eds. American Architect.]

NOTES AND CLIPPINGS

The Duchesse de Galliera. — As the late Duchesse de Galliera expended more money than any lady of our time upon building and construction, her death should not be allowed to pass unnoticed in this journal. The name of the Duchesse does not, moreover, appear for the first time in *The Architect*, as the fine series of illustrations of the "Cities of Italy" which we published in 1873 were from paintings by Paul Baudry in the mansion of the Duchesse in the Rue de Varennes. The Duchesse was born in Genoa, and that city owes much to her liberality. A sum of 25,000,000 francs was expended on the harbor, the mansion belonging to the Duc, with its contents, a gift valued at 7,000,000 francs, was made over to Genoa, and in addition two hospitals were constructed at a cost of 7,000,000 francs. In Paris the erection of the Musée Galliera cost 5,000,000 francs, and a still larger sum would have been expended but for an error in drafting a deed by which the Musée became the property of the city, when the donor's intention was to enrich the State. Two blocks of workmen's houses cost 2,000,000 francs; 11,000,000 francs were spent on the erection and endowment of the Hôpital de Clamart, and no less than 24,000,000 francs upon the erection and endowment of an orphanage at Fleury, and an asylum at Meudon. The Duc was known as a great railway contractor and speculator, and is said to have left a fortune to his widow that was valued at nine millions sterling. The greater part of that vast sum has been expended for benevolent purposes, and builders have reason to regret the loss of so munificent an enthusiast. — *The Architect.*

Heating Buildings by Exhaust Steam. — At a recent meeting of the New England Railway Club, John A. Coleman said: I have had a long experience in heating buildings by steam. When the matter of using exhaust steam was agitated, and most people were opposed to it, we took a number of mills, using then a sixteen-foot tubular boiler, and averaged a ton of coal a day. We heated the mill by using large pipes, having the circulation as straight as possible, open and free, with about two pounds back pressure on the engine, using no direct steam except in the morning in starting up and on Sundays. I had similar experience in heating the building of the Providence Tool Company during the war. The building was seventy feet wide by more than two hundred long, the rooms with fifteen-foot studs, and large windows in an exposed situation, then heated by small pipes all around the walls, and using about a ton of coal a day for the boiler. In reconstructing we took out the small pipe, cut it up into coils, which we placed in the centre of the building, using a six-inch pipe as the main artery through the building, and a two-inch socket-pipe for the condensed water, avoiding bends everywhere as much as possible. Result was that the building was overheated by using only exhaust steam, and about two pounds back pressure and no extra coal was used for the fires. My idea in heating is to use large pipes and carry a large body of steam to the point where you want to use it, and not strangle it on the way. — *Iron Age.*

Another Big Well in Iowa. — A Waterloo (Ia.) despatch to the Chicago *Tribune* says: "The flowing well near Tripoli, Bremer County, is attracting considerable attention, as it appears to be another Belle Plaine gusher on a slightly smaller scale. It is located on the farm of J. J. Cooke, about three miles east of Tripoli, and only a short distance from the Wapsie River. The well was drilled down through the rock and sand about 135 feet. Water was struck several times, and when a depth of 129 feet was reached the water filled the well to within eight feet of the surface. After drilling two hours longer the water began to overflow. Work was stopped and a six-inch casing put in. At three o'clock the next morning, December 30, Mr. Cooke was awakened by a roaring noise, and, on going to the well, he found the water spouting about three feet above the top of the tubing and throwing out blue sand and clay. After throwing out about three wagon-loads of this débris the water became clearer, but its force increased until it rose fully six feet above the top of the casing, besides opening the seams in the casing at several places. Four joints of stovepipe were then put on the casing, and the water flowed in a torrent from the top of this improvised tube fully twelve feet from the ground. "Since then the well seems to have lost some of its force, but it still sends out a stream, which, if confined, would, it is estimated, throw a three-inch stream fifty feet high. It is the intention to replace the casing in the well with a six-inch gas-pipe, and in that way it is expected that the flow of water can be controlled.

TRADE SURVEYS

Building authorities in six or eight of the larger cities of the country who have gone to the trouble of examining into building probabilities for the ensuing year, are strongly inclined to believe that taking the country all through there will be an increase this year of five to ten per cent at least in building operations which will be mainly of small houses in the smaller cities and towns. This statement is based upon the opinion or belief that most of the manufacturing expansion will be made in these cities where advantages are very inviting, more so than in larger cities where real estate is high and taxes oppressive. Besides, circumstances and factors are still at work and more strongly now than at any time point to a multitude of smaller industries through localities now barren. This tendency is apparent in any direction that observation is made. The advantages of location in the larger Eastern cities are not as great as they were a few years ago when special rates gave shippers there advantages over other nearer consumers. A second fact is that fuel is being supplied in a large section of country at a low price where heretofore it was not to be had at any excepting extremely high prices, and third, artificial fuel is now being made at very low prices. Manufacturers recognize that this fuel is now being made and utilized very generally in localities which heretofore have been almost without manufacturing facilities. Another factor which is worth noting as contributing to this scattering tendency among our industries is the willingness of capital to benefit itself with bringing industries almost anywhere. The fact has been mentioned heretofore that there is less opportunity and inducement for capital to go into railroad enterprises and it must therefore seek industrial channels. This tendency is a very marked one The large volume of capital that has found its way into the Southern States during the past year shows the strength of the movement. On account of the lack of facilities for obtaining reliable statistical information concerning new industries, only guesses can be made or statements relied upon by the leaders in these new industrial enterprises in these new sections from reliable authorities in far off cities such as Nashville, New Orleans, Kansas City, Fort Worth and smaller towns attracting a much more general movement of capital into the country of which these cities are at present the business centres. All of this activity means that house-building will be prosecuted more vigorously. There has been a scarcity of houses all over the new West and the new South and the necessity has of late induced a good many to undertake to supply it. Another influence deserving of study is the continued outflow of Eastern reserves to Western farmers. Some writers indulge in apprehensions over this tendency and regard it as dangerous. The West is very deeply indebted to the East but its productive capacity is being correspondingly increased and the borrowers at the end of the season have more wealth than they would have had had they not obtained the assistance of capital. The rates of interest are slowly moving downward and with this tendency the supplies of money seem to increase. Real estate in these new sections is rather declining excepting in the larger cities where business is more immense and elements of uncertainty have been more generally removed. Putting all these things together and a good many more, building authorities have expressed opinions thus early in the season and are quite certain that work will be abundant and that building material of all kinds will be in active demand. The brick-makers seem to be acting in view of this probability. The lumber manufacturers are doing the same. White and yellow pine will come into very sharp competition throughout the West. The Arkansas supply will be thrown into the market and will probably help to depress the Michigan and Wisconsin products. Southern railroad managers are giving attention to the lumber traffic as well as to the iron traffic with a view to increasing their receipts from these sources. On iron, freight rates were advanced last week very high, to fifty cents to Western points and to Southern points twenty cents per ton. These conflicting rates show what railroaders propose to do. On the old lines they propose to charge all the traffic will bear and on the new roads they propose to increase the volume of business as much as possible. Late advices from the cotton-fields in the South show that the increase of capacity will not be so great this year, not that there are any actual disagreements. The lumber concerns are securing a greater control over production and increase their capacity at smaller cost than new mills starting up. The iron-makers throughout the country report a backward demand just at present. The steel-rail makers have nothing whatever to say. The amount of railroad building is uncertain Regarding the probability of a combination among all of the big roads of the country it can be stated that it is almost chimerical. The leaders of the great system will want to retain their independence and control over their respective systems. They recognize that there are a great many dangers to be encountered in the development of the railway systems of the country, that a great many risks are to be run and that some of the roads may go down under the contest. Besides, they are sure that the Government and the railway commission will deal more leniently with them although holding them to the law as it is, with perhaps a few unimportant modifications effected for the lubricating of rough places.

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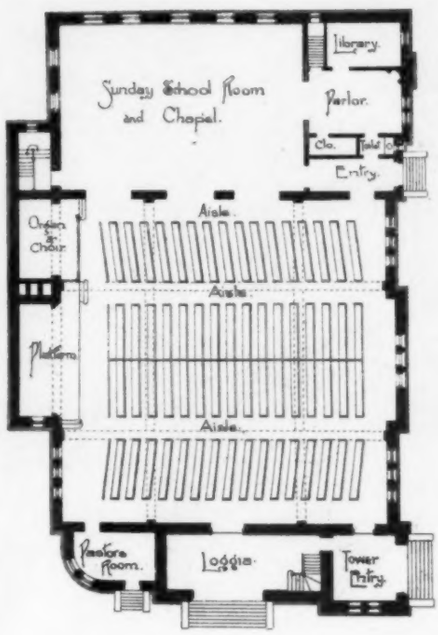
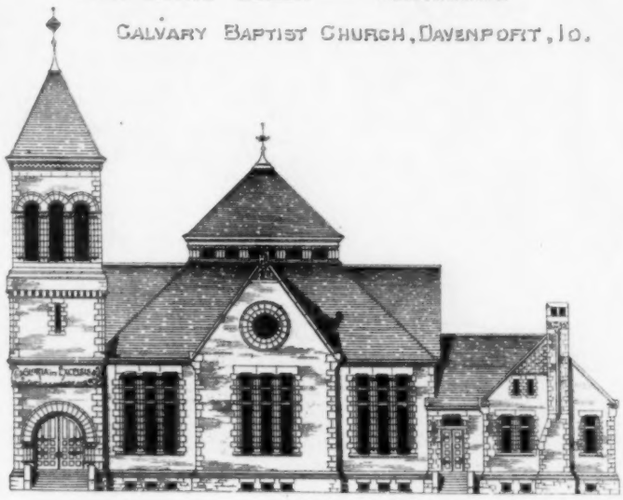
COMPETITIVE DESIGN — ALTERNATIVE

CALVARY BAPTIST CHURCH, DAVENPORT, IO.

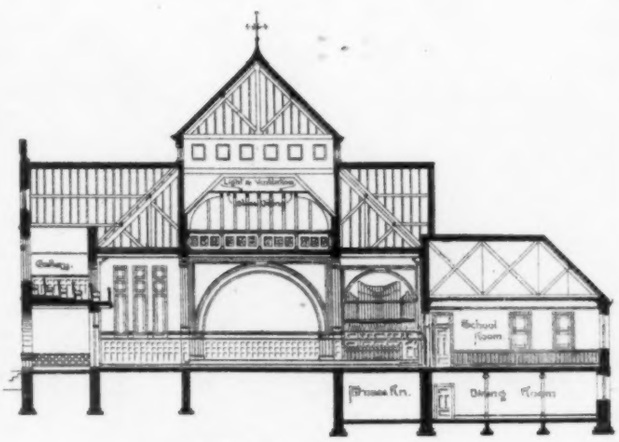


PLAN.



SIDE ELEVATION.

FRONT ELEVATION.



LONGITUDINAL SECTION.

W.R. Cowle, Architect, Milwaukee.

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PLAN OF CHANCEL.

PULPIT.
CHOIR STALLS.
AND
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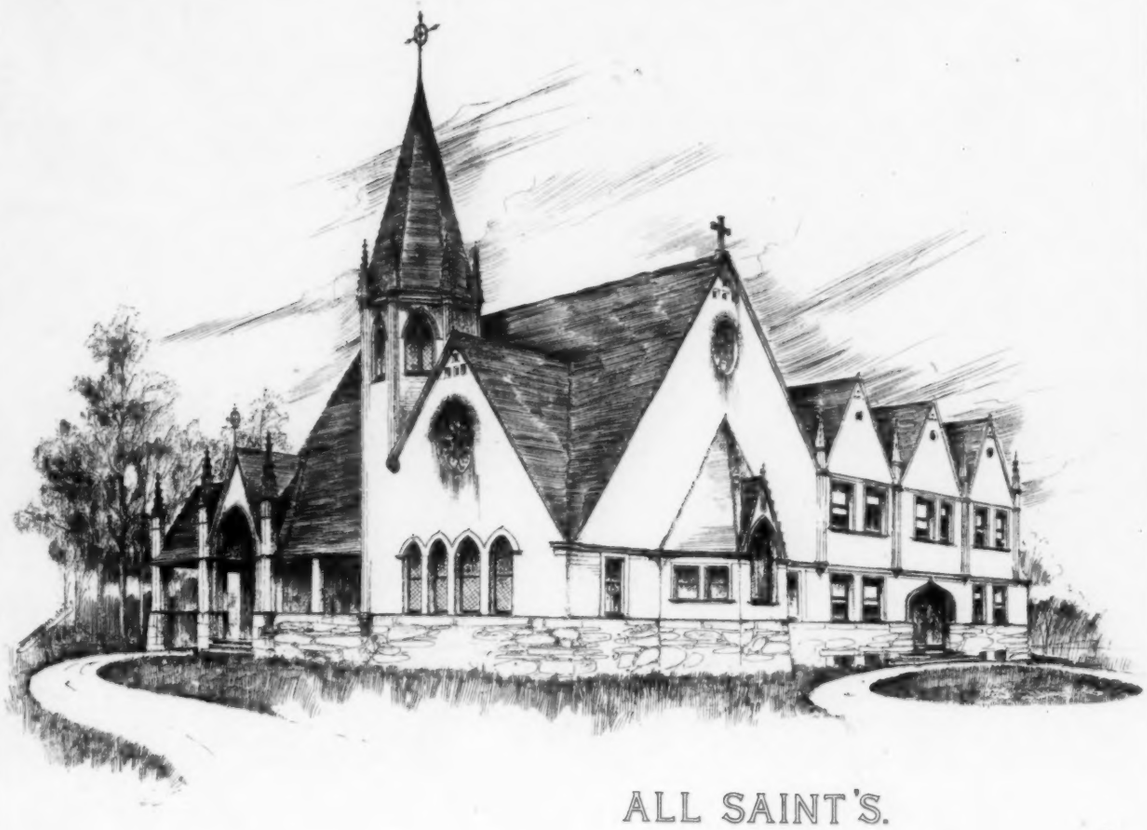

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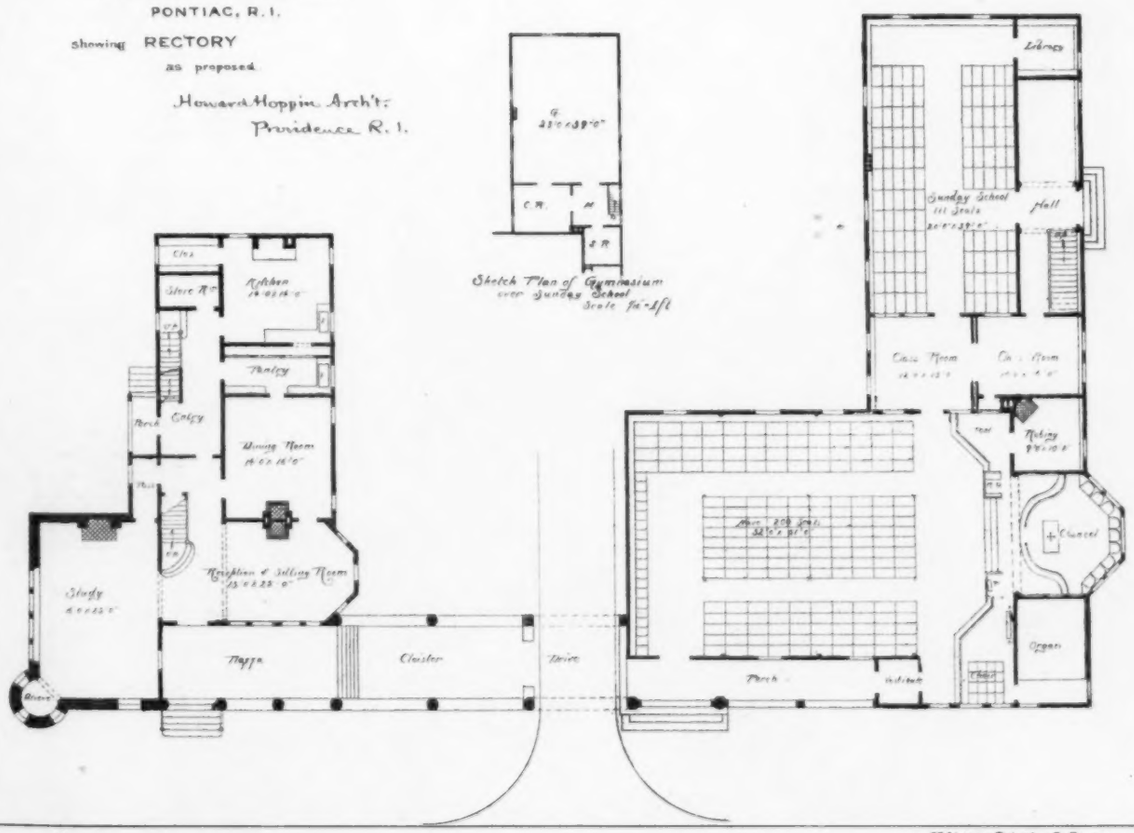

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